

BUREAU OF FISHERIES

(639.73)  
§ Fishes

Division of Fishes,  
U. S. National Museum

REPORT

OF THE

UNITED STATES  
COMMISSIONER OF FISHERIES

FOR THE FISCAL YEAR 1917

WITH

APPENDIXES

HUGH M. SMITH

Commissioner



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1919

DEPARTMENT OF AGRICULTURE

REPORT

OF THE

UNITED STATES

COMMISSIONER OF AGRICULTURE

FOR THE YEAR 1900

ALBANY

W. H. BROWN

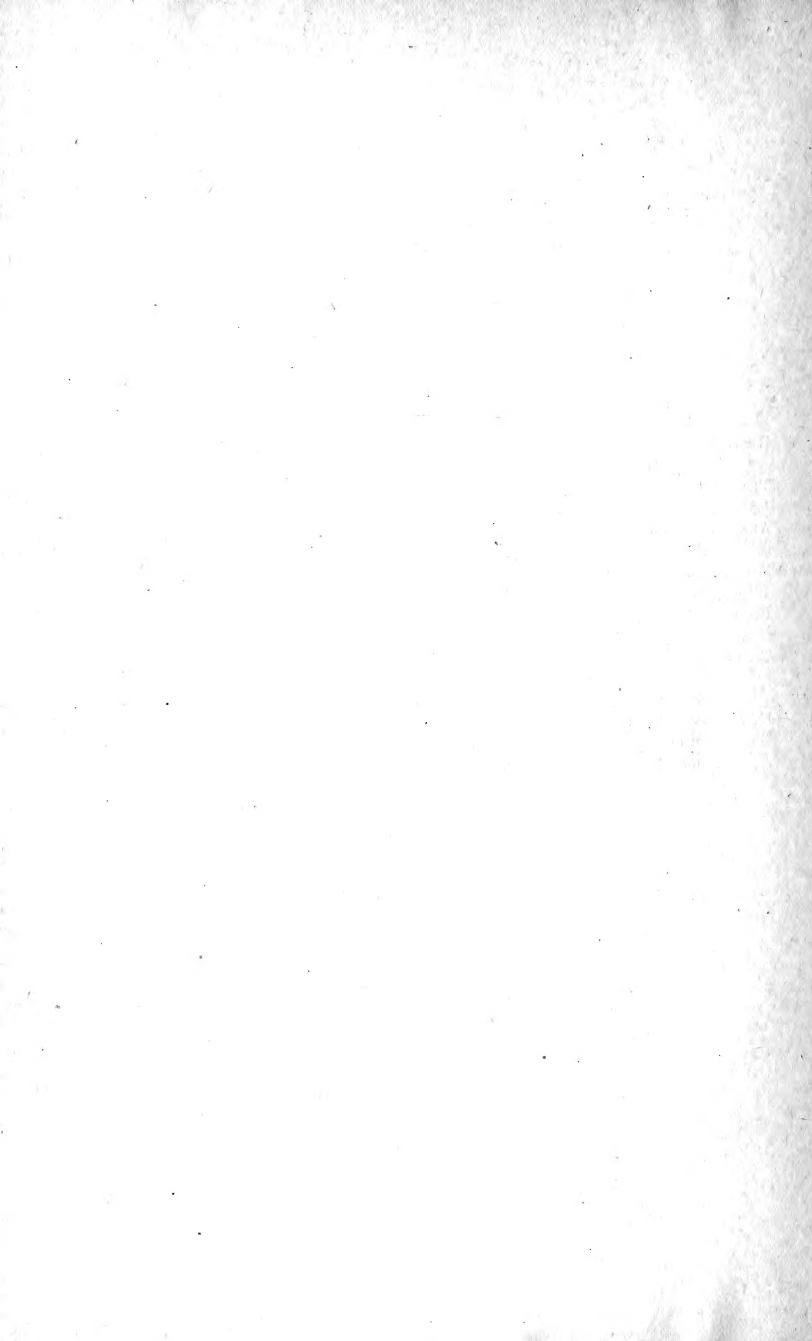


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**REPORT OF THE  
UNITED STATES COMMISSIONER OF FISHERIES  
FOR THE FISCAL YEAR ENDED  
JUNE 30, 1917**



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# REPORT

OF THE

## COMMISSIONER OF FISHERIES.

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DEPARTMENT OF COMMERCE,  
BUREAU OF FISHERIES,  
*Washington, October 4, 1917.*

SIR: There is submitted herewith a report covering in outline the operations and activities of the Bureau of Fisheries during the fiscal year ended June 30, 1917.

### GENERAL ADMINISTRATIVE CONSIDERATIONS.

The past fiscal year may properly be regarded as the most important and successful in the recent history of the Bureau. The service was better equipped than ever before in both material facilities and personnel; it received liberal financial support from Congress and generous criticism and appreciation from the public; it was enabled to extend and expand its activities so as to serve in a most acceptable manner a large usefulness to the fishing industry and the country at large; it was privileged to make special adaptation of its investigational and technical operations to meet the great national emergency; and at the beginning of the current fiscal year its outlook for continued and increased usefulness in all lines of activity was most promising.

The Bureau's administrative staff at headquarters at the beginning of the fiscal year consisted of H. F. Moore, Deputy Commissioner; Irving H. Dunlap, assistant in charge of office; Henry O'Malley, assistant in charge of fish culture; Robert E. Coker, assistant in charge of inquiry respecting food fishes and the fishing grounds; Alvin B. Alexander, assistant in charge of statistics and methods of fisheries; and Ward T. Bower, chief agent of the Alaska service. On October 31, 1916, the death of Mr. Alexander deprived the Bureau of an able and loyal employee, who had been in the service since 1887 and chief of division since 1903. He was succeeded by Lewis Radcliffe, who has been in the Bureau since 1907, serving for two years as director of the biological laboratory at Beaufort, N. C., and later as assistant in the division of scientific inquiry. To each of the foregoing and to the rank and file throughout the country the Commissioner extends his appreciative thanks and commends them to the Secretary for efficient and faithful service that has made the year exceptionally fruitful.

The appropriations for the Bureau of Fisheries for the fiscal year 1917 aggregated \$1,144,850, as follows:

Salaries.....	\$427,350
Miscellaneous expenses:	
Administration.....	10,000
Propagation of food fishes.....	360,000
Maintenance of vessels.....	80,000
Inquiry respecting food fishes.....	42,000
Statistical inquiry.....	7,500
Protecting sponge fisheries.....	3,000
Protecting seal and salmon fisheries of Alaska.....	75,000
Investigating damages to fishes.....	25,000
Completion of and improvements at stations:	
Gloucester, Mass.....	3,000
Duluth, Minn.....	2,000
Key West, Fla.....	25,000
Lobster-rearing plant.....	5,000
Two steel distribution cars.....	40,000
Two motor boats, Alaska service.....	10,000
Buildings and improvements, Pribilof Islands, Alaska.....	20,000
Repairs, steamer <i>Albatross</i> (deficiency).....	10,000

A detailed report of the expenditures under each of these appropriations will be submitted in accordance with law.

### THE COMMERCIAL FISHERIES.

#### OUTLINE OF ACTIVITIES.

The activities of the Bureau in relation to the commercial fisheries, over which it should be understood the Government exercises no jurisdiction or supervision except in Alaska, have included the following subjects during the fiscal year 1917: Canvass of the entire fishing industry of the Pacific States; canvass of the shrimp industry of the South Atlantic and Gulf States; collection of detailed statistics of the vessel fisheries centering at Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash., and the publication of this information for the use of the trade in monthly and annual one-sheet bulletins; practical studies of the methods of preparing fishery products for food, fertilizer, and other purposes; prosecution of an active campaign for the more extensive production, distribution, and utilization of fish for food, particularly certain species that have heretofore entered into the food supply only to a limited extent; demonstrations and investigations addressed to the proper and more complete utilization of waste products of the fisheries; practical assistance to the fishermen through demonstration of new or improved methods of handling and preparing their catch; aid in establishing and promoting a hydroid fishery in United States waters; investigations of new aquatic sources of leather, and conduct of active work in the interests of fishermen and tanners looking to the use of skins of various fishes and other water animals in manufacturing leather; and the dissemination among fishermen and fish packers of a very large amount of descriptive matter on the preservation and utilization of fishery products.

#### SHRIMP INDUSTRY OF THE SOUTH ATLANTIC AND GULF STATES.

One of the most important fisheries of the South Atlantic and Gulf States is that for shrimp. The Bureau has recently completed a canvass of this industry for 1916, which reveals a surprising growth

as compared with previous canvasses. The aggregate catch in that year was 43,942,105 pounds with a value of \$758,620, an increase of 136.7 per cent in quantity and 72.9 per cent in value over the last canvass, that of the Bureau of the Census for 1908. Louisiana still remains the center of the industry, over 41 per cent of the entire catch, or 18,160,586 pounds, being accredited to it; Florida is second with 11,549,175 pounds; Mississippi third with 8,899,350 pounds; and Georgia fourth with 4,261,480 pounds. The remaining States of North Carolina, Texas, South Carolina, and Alabama ranking in the order named, produced less than 2.5 per cent of the entire catch.

The number of persons engaged in the industry was 9,235, of whom 3,645 were fishermen, 89 on transporting vessels, and 5,501 in the shore industries. The investment in boats, fishing apparatus, shore and accessory property, and cash capital aggregated \$2,484,625, and the wages paid in the canning and drying industries amounted to \$246,775. The cost of cans, paper linings, labels, and cases for canned shrimp was \$331,162. The wholesale trade in raw, dry-cooked, and pickled shrimp totaled 5,780,090 pounds, valued at \$430,123.

Three marine species of shrimp are taken for commercial purposes. Of these the most important and abundant form is *Penæus setiferus*, which occurs throughout the range of the fishery from Beaufort, N. C., to Corpus Christi, Tex. The closely related species *P. brasiliensis* is much less abundant and may be distinguished from the other by the character of the groove along each side of the rostrum which extends nearly to the posterior margin of the carapace, while in *P. setiferus* this groove extends less than halfway back. As the fishermen do not recognize these differences, an estimate of the relative importance of *P. brasiliensis* is difficult. The third species, *Xiphopenæus kroyeri*, commonly known to the fishermen as "sea-bobs" or "seven-beards," is considerably smaller, differs in color and general appearance, and has a rostrum as long as or longer than the carapace instead of shorter, as in the species of *Penæus*. It is taken commercially only on the Louisiana coast, where it is used solely for drying when the larger species are unobtainable.

On the Atlantic coast the bulk of the shrimp are taken with otter trawls and on the Gulf coast with haul seines, except in Texas where cast nets are used almost exclusively. At Apalachicola, Fla., and Biloxi, Miss., the otter trawl has recently been introduced and is expected to play an increasingly important part in the shrimp fishery of the Gulf coast. In the trawl fishery, motor boats with crews of one to three men are employed. In the Mississippi haul-seine fishery, sail schooners about 40 feet in length serve to carry the fishermen to the fishing grounds, 25 to 80 miles distant, and the catch to the factory. In operating the seine a motor boat and a rowboat are used. The seines range from 175 to 250 fathoms in length and 11 to 18 feet in depth and are operated by crews of 6 men. In Louisiana, the fishermen establish camps near the fishing grounds, the latter being visited in open motor boats. The haul seines employed in this State average about 300 fathoms in length. Gasoline luggers make frequent trips to the fishing grounds to transport the catch to the canning factories, most of which are located in New Orleans.

The irregularity of the movements of the shrimps makes it difficult to define the seasons of abundance in the various waters. In general,

the season in North Carolina is August to November; in South Carolina July to November; in Georgia and east Florida the year round, with irregular slack periods; in west Florida October to July; in Mississippi March, April, and July to December; in Louisiana February to May and July to November; in Galveston Bay, Tex., March to November; and in Corpus Christi Bay, Tex., throughout the year with longer or shorter periods of slackness. The introduction of the otter trawl in Mississippi may lengthen the season in that State.

In 1916, 448,443 cases of canned shrimp, with a value of \$1,436,851 were produced. The principal canning center is Biloxi, Miss., at which place not less than 13 plants are operated. New Orleans is second in importance. Shrimp were also canned at Houma, La.; Lakeshore, Bay St. Louis, Pass Christian, and Ocean Springs, Miss.; Apalachicola, Fernandina, and Nassauville, Fla.; Valona and Brunswick, Ga.; and Southport, N. C.

The canning operations are quite simple. The meat is separated by hand from the heads and shells, thoroughly washed in fresh water, and cooked in wooden tanks for 5 to 10 minutes in boiling water to which sufficient salt for seasoning has been added. The meat is then spread on wire-meshed trays to cool and is then packed in the cans by hand. The cans are of two sizes, holding about 4 and 8 ounces of meat, respectively. For the dry pack, the cans are lined with parchment paper cut to size by the dealer supplying it. The paper prevents the discoloration which results when the meat is in direct contact with the tin. In the wet pack most operators have abandoned the use of the lining without unfavorable results. For this pack the cans are filled with brine. After capping, the cans are processed in steam-tight retorts at 240° F., the smaller cans for 8 to 10 minutes and the larger cans for 12 to 14 minutes; the dry-pack cans for 60 to 70 minutes.

The drying of shrimp is an important industry in Louisiana, fully half the catch being preserved in this manner. Most of the drying is done along the shores of Barataria and Timbalier Bays. Without removing heads or shells, the shrimp are boiled for about 30 minutes in large kettles of water to which salt has been added in the proportion of 10 to 20 quarts, depending on weather conditions, for each 900 pounds of shrimps. They are then spread on large wooden drying platforms at a depth not to exceed 2 to 3 inches and dried in the sun, being turned over every 20 or 30 minutes. Under favorable weather conditions, the drying is completed in 1 or 2 days. The shrimp are then pushed into circular piles and the meat threshed out by workmen walking round and round over them. This primitive method of freeing meat from heads and shells is termed "dancing the shrimp." The meat is then separated from the shells by sifting and packed in barrels for shipment. The product is sold for food in Cuba, Central and South America, and in a number of large cities in the United States. The heads and shells which have been more or less pulverized into a meal or bran by the dancing process are sacked and sold for fertilizer. In 1916, this industry yielded 1,368,346 pounds of dried shrimp, valued at \$183,144 and 684 tons of fertilizer valued at \$12,067. Statistics of the industry in detail are given in the following table:



## SHRIMP INDUSTRY OF THE SOUTH ATLANTIC AND GULF STATES, 1916.

Items.	North Carolina, South Carolina, and Georgia. <sup>a</sup>		Florida.		Alabama and Missis- sippi. <sup>b</sup>		Louisiana.		Texas.		Total.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	
Persons engaged:											
On vessels fishing.....	31		24		c 751		5				811
On vessels transporting.....					49		49				89
In shore or boat fisheries.....	359		502		1,629		1,629		228		2,834
In canning industry.....	700		691		2,450		1,547				5,388
In drying industry.....							113				113
Total.....	1,090		1,217		3,357		3,343		228		9,235
Wages paid:											
In canning industry.....		\$33,866		\$48,058		\$80,663		\$65,538			\$228,125
In drying industry.....								18,650			18,650
Total.....		33,866		48,058		80,663		84,188			246,775
Cost of cans, paper linings, labels, and cases for canned shrimp.....		42,946		76,206		134,296		77,714			331,162
Plants:											
Canning.....	6		5		16		8				35
Drying.....							d 11				11
Total.....	6		5		16		19				46
Vessels fishing.....											
Net tonnage.....	10	24,000	12	10,400	123	237,475	1	350			146
Outfit.....	86		88		1,610		8				1,792
Vessels transporting.....		7,900		9,900		94,538		200			112,538
Net tonnage.....					13	30,545	17	32,490			30
Outfit.....					153		146				299
Gasoline boats.....	120	101,950	246	166,250		10,190		23,150			33,340
Sail and row boats.....	40	600			89	36,140	201	79,975			656
Apparatus—Vessel fisheries:					26	4,720	85	2,550	180	\$3,640	384,315
Haul seines.....											11,510
Other trawls.....	21	820	24	840	122	33,370	1	225			33,595
					4	150					1,810

<sup>a</sup> These States are considered collectively to avoid disclosure of individual business.<sup>b</sup> As the catch was small and no shrimp were packed in Alabama, that State is combined with Mississippi.<sup>c</sup> Includes 120 men who were also engaged a brief portion of the year in the shore or boat fisheries.<sup>d</sup> This number does not include the outfits used by individual fishermen in drying their own catch.

## SHRIMP INDUSTRY OF THE SOUTH ATLANTIC AND GULF STATES, 1916—Continued.

Items.	North Carolina, South Carolina, and Georgia.		Florida.		Alabama and Missis- sippl.		Louisiana.		Texas.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Apparatus—Shore fisheries:												
Haul seines.....	16	\$2,450			16	\$3,350	178	\$38,255	8	\$800	218	\$44,855
Other trawls.....	189	5,150	455	\$14,945	84	2,475	39	150	216	1,280	728	22,570
Cast nets.....	40	240									295	1,570
Shore and accessory property:												
In fishery.....		2,260				1,100		8,425				11,785
In canning industry.....		98,500		63,000		269,800		317,000				748,300
In drying industry.....								76,600				76,600
Cash capital:												
In canning industry.....		76,000		120,000		270,800		174,197				640,997
In drying industry.....								25,500				25,500
Total.....		319,870		385,335		994,653		779,017		5,720		2,484,625
PRODUCTS.												
Catch of shrimp:												
Vessel fisheries—												
With haul seines.....												
With other trawls.....	680,200	15,770	948,295	14,452	7,426,350	130,133	14,400	216			7,440,750	130,349
With other trawls.....					200,000	3,000					1,828,405	33,222
do.....												
Total.....	680,200	15,770	948,295	14,452	7,626,350	133,133	14,400	216			9,269,245	163,571
Shore fisheries—												
With haul seines.....	333,945	9,323			336,250	6,391	18,100,186	233,819	3,314	165	18,773,685	249,698
With other trawls.....	3,931,280	88,601	10,600,880	217,666	939,750	17,900	46,000	1,270			15,471,910	324,167
With cast nets.....	60,000	2,400							321,255	17,514	427,255	21,184
do.....												
Total.....	4,325,225	100,324	10,600,880	217,666	1,276,000	24,291	18,146,186	235,089	324,569	17,679	34,672,860	595,049
Grand total.....	5,005,425	116,094	11,549,175	232,118	8,902,350	157,424	18,100,586	235,305	324,569	17,679	43,942,105	758,620
Canned shrimp:												
Wet pack—												
No. 1 cans.....	25,981	86,544	69,913	221,148	103,984	322,515	63,271	200,793			203,149	831,000
No. 1½ cans.....	1,613	5,553	6,586	19,778	4,517	14,617	7,343	23,870			20,059	63,818
do.....												
Dry pack—												
No. 1 cans.....	20,379	71,578	26,287	82,121	46,709	151,435	35,995	118,439			129,370	423,573
No. 1½ cans.....	13,233	44,249	6,080	18,678	11,125	37,766	5,427	17,767			35,865	118,460
do.....												
Total.....	61,206	207,924	108,866	341,725	166,335	526,333	112,036	300,869			448,443	1,436,851

[illegible]

a 48 cans to a case.

**b 24 cans to a case.**

COMPARATIVE STATISTICS OF THE SHRIMP CATCH OF THE SOUTH ATLANTIC AND GULF STATES FOR VARIOUS YEARS FROM 1880 TO 1916.<sup>a</sup>

Year.	North Carolina.		South Carolina.		Georgia.		Florida.		Alabama.		Mississippi.		Louisiana.		Texas.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.		
1880	63,000	\$4,500	630,000	\$37,500	58,000	\$4,000	71,750	\$3,500	(b)	(b)	1,144,800	\$23,646	534,000	\$41,708	654,633	\$27,540	1,992,250	\$118,800
1881	120,110	4,503	338,000	18,400	195,000	6,500	(b)	(b)	(b)	(b)	1,092,800	22,566	6,800,080	99,408	237,950	8,822,253	157,407	1,982,500
1882	124,000	4,650	388,860	18,800	180,650	6,800	152,000	5,800	43,750	\$5,000	1,092,800	22,566	6,942,700	93,452	239,333	7,950	9,164,083	163,078
1883	135,240	5,100	380,400	19,020	188,900	5,975	78,000	2,805	30,000	600	794,200	16,741	7,268,500	95,832	241,500	7,555	9,047,840	153,678
1884	144,200	5,435	371,840	18,392	162,160	6,081	65,825	2,357	(b)	(b)	613,500	12,622	6,062,050	90,319	175,800	6,570	9,156,375	141,476
1885	(b)	(b)	(b)	(b)	(b)	(b)	62,025	2,397	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
1886	146,496	5,885	374,500	18,395	67,600	2,535	38,025	1,497	40,000	609	1,903,165	28,804	4,486,726	80,576	360,530	7,464	7,418,242	145,765
1887	341,160	7,900	392,500	12,002	344,127	8,408	3,030,134	63,218	200	12	4,423,900	58,398	7,634,720	131,715	800,815	8,566	16,177,556	285,619
1888	371,000	9,000	409,000	19,000	528,000	9,000	4,535,000	92,000	37,000	1,200	4,121,000	81,000	8,581,000	213,000	118,000	4,400	18,561,000	438,600
1889	683,945	16,323	60,000	2,400	4,261,480	97,371	11,549,175	232,118	3,000	42	8,869,350	157,382	18,160,586	235,305	324,569	17,679	43,942,105	758,620

<sup>a</sup> The statistics for 1908 in this table are from data published by the Bureau of the Census.

<sup>b</sup> Statistics not available.

## NEW ENGLAND VESSEL FISHERIES.

Statistics of the vessel fisheries centering at Boston and Gloucester, Mass., and Portland, Me., have been collected during the year by the local agents and published promptly in monthly bulletins showing, by species and fishing grounds, the quantities and values of fishery products landed by American fishing vessels at these ports. Two annual bulletins also have been issued, one showing the catch by months and the other by fishing grounds.

The fleet landing fishery products at these ports in 1916 included 512 sail, steam, and gasoline screw vessels. These vessels landed at Boston 3,089 trips, aggregating 98,331,038 pounds of fish, valued at \$3,702,365; at Gloucester 2,864 trips, aggregating 66,680,548 pounds, valued at \$2,159,894; and at Portland 2,992 trips, aggregating 20,812,839 pounds, valued at \$521,647. The total for the three ports amounted to 8,945 trips, aggregating 185,824,425 pounds of fresh and salted fish, having a value to the fishermen of \$6,383,906. No comparison with previous returns can be made for Portland, as this is the first year the products landed at that port have been included in these statistics. At Boston and Gloucester, as compared with the previous year, there was a decrease of 1,291 trips and of 6,584,142 pounds in the quantity, but an increase of \$1,124,342 in the value of the fish landed. The catch of cod decreased 4,489,950 pounds, haddock 2,684,498 pounds, hake 4,258,410 pounds, cusk 1,085,389 pounds, halibut 947,234 pounds, and swordfish 483,345 pounds, but all of these species increased in value except hake, which declined about 1 per cent. The mackerel catch increased 4,225,945 pounds, or 38.70 per cent in quantity, and \$396,331, or 64.54 per cent in value. There was also considerable increase in the quantity and value of herring, pollock, and miscellaneous products. The catch of Newfoundland herring decreased 26,715 pounds, or less than 1 per cent, in quantity, but increased \$70,275, or 27.48 per cent, in value. The catch of tilefish landed at Boston during the year amounted to 873,142 pounds, having a value of \$24,295.

The following tables present in detail, by fishing grounds and by months, the products of the vessel fisheries of Boston and Gloucester, Mass., and Portland, Me., for the calendar year 1916. The weights of fresh and salted fish given in these statistics represent the fish as landed from the vessels, and the values are those received by the fishermen. The grades, or sizes, given for certain species are those recognized in the trade.

QUANTITIES AND VALUES OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., BY AMERICAN FISHERY VESSELS DURING THE CALENDAR YEAR 1916, SHOWN BY FISHING GROUNDS.

Fishing grounds.	Num-ber of trips.	Cod.							
		Large (10 pounds and over).				Market (under 10 and over 2½ pounds).			
		Fresh.		Salted.		Fresh.		Salted.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
LANDED AT BOSTON.									
<i>East of 66° west longitude.</i>									
La Have Bank.....	18	68,223	\$2,430			106,960	\$2,607		
Western Bank.....	74	427,664	19,293			657,179	21,358		
Quebec Bank.....	5	38,540	1,385			43,360	596		
Green Bank.....	1	20,000	1,000						
Grand Bank.....	5								
Burgo Bank.....	2								
Off Newfoundland.....	4								
Cape Shore.....	108	412,466	19,765			477,022	13,171		
Gulf of St. Lawrence.....	2								
St. Ann's Bank.....	3	40,935	1,553			73,250	2,079		
<i>West of 66° west longitude.</i>									
Browns Bank.....	224	1,410,321	60,110			1,617,869	45,140		
Georges Bank.....	489	2,094,022	104,017			2,210,856	73,365		
Cashes Bank.....	16	40,769	1,622			35,630	1,015		
Clark Bank.....	11	16,435	854			2,000	475		
Fluorides Bank.....	83	34,915	2,014			44,407	1,886		
Middle Bank.....	532	303,362	17,773			298,478	11,570		
Jeffrey's Ledge.....	31	134,582	5,185			29,035	1,111		
Isola Bay.....	455	64,938	42,457			1,230,410	47,952		
South Channel.....	98	212,806	13,560			784,008	26,965		
Norfolk Shoals.....	4	5,429	140			2,710	87		
Off Highland Light.....	489	1,422,194	80,806			1,725,582	58,083		
Off Chatham.....	3								
Off Race Point.....	5	4,775	171			6,885	170		
Bay of Fundy.....	6	18,055	1,174			43,860	1,560		
Seal Island.....	24								
Shore, general.....	396	300,730	14,325			193,772	6,297		
Total.....	3,089	7,649,811	389,726			9,599,973	315,550		



## LANDED AT PORTLAND.

*East of 66° west longitude.*

La Have Bank.....	8	8,502	507	2,790	140	1,885	53	2,415	112	340	5	.....
Western Bank.....	14	63,305	1,146	.....	.....	105,234	1,432	.....	.....	9,724	111	.....
Quebec Bank.....	2	4,060	110	.....	.....	3,000	68	.....	.....	.....	.....	.....
Green Bank.....	1	22,790	520	35,290	1,499	.....	.....	835	33	.....	.....	.....
Grand Bank.....	1	885	23	7,060	345	6,620	159	34,450	1,378	110	1	4,815
St. Peters Bank.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	132
Baccalieu Bank.....	1	29,910	1,458	.....	.....	12,500	533	.....	.....	.....	.....	.....
Cape North.....	2	5,180	120	.....	.....	2,925	66	.....	.....	.....	.....	.....
Cape Shore.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
The Gully.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<i>West of 66° west longitude.</i>												
Browns Bank.....	4	5,355	271	.....	.....	1,470	48	.....	.....	.....	.....	.....
Georges Bank.....	13	59,009	1,654	3,460	175	26,707	649	4,865	210	710	11	.....
Cashes Bank.....	45	19,985	802	.....	.....	23,204	626	.....	.....	3,965	38	.....
Jeffreys Ledge.....	57	42,198	2,302	.....	.....	55,251	1,956	.....	.....	8,187	125	.....
South Channel.....	24	18,008	421	.....	.....	62,875	995	.....	.....	2,893	26	.....
Shore, general.....	2,806	1,156,076	62,975	2,385	124	938,852	33,635	991	45	229,499	3,595	12
Total.....	2,992	1,440,323	72,569	51,585	2,283	1,200,523	40,240	43,556	1,778	255,428	3,912	5,200
Grand total.....	8,945	16,816,040	683,095	4,493,280	212,140	17,470,503	503,899	2,827,208	117,290	1,706,546	26,575	303,925

## Haddock.

## Hake.

Fishing grounds.		Large (over 2½ pounds).		Scrod (1 to 2½ pounds).		Large (6 pounds and over).		Small (under 6 pounds).	
		Fresh.	Salted.	Fresh.	Salted.	Fresh.	Salted.	Fresh.	Salted.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
<b>LANDED AT BOSTON.</b>									
<i>East of 66° west longitude.</i>									
La Have Bank.....	220,050	\$5,251	.....	33,425	\$491	98,093	\$3,111	90,259	\$1,811
Western Bank.....	3,190,600	100,422	.....	817,059	20,669	8,060	192	7,531	285
Quebec Bank.....	.....	.....	.....	.....	.....	.....	.....	5,102	227
Cape Shore.....	1,860,265	75,841	.....	194,626	4,471	98,296	4,034	190,447	5,093
St. Ann's Bank.....	73,400	3,095	.....	13,220	275	.....	.....	400	16





# REPORT OF THE COMMISSIONER OF FISHERIES.

Cape Shore.....	170,418	2,079	25,500	512	8,000	88	166,515	2,512	5,822	149			
Gulf of St. Lawrence.....	10,555	127	3,830	99			78,625	1,193	2,499	64			
St. Ann's Bank.....	14,345	109	120	4			7,145	92	510	9			
The Gully.....							40,151	741	425	7			
<i>West of 66° west longitude.</i>													
Browns Bank.....	1,229,771	16,844			198,038	2,396	82,870	1,071			11,770	147	
Georges Bank.....	1,438,285	23,552	8,483	192	52,860	634	64,993	976	70	1			
South Channel.....	246,310	3,448					550	8					
Nantucket Shoals.....	7,060	124	2,105	42									
Seal Island.....							420	5					
Shore, general.....	733,002	29,570	25	1			733,182	22,512	153	3	6,844	460	
Total.....	6,276,223	109,097	78,000	1,595	353,058	4,274	2,821,172	55,061	138,170	2,783	19,284	619	1,000
LANDED AT PORT-													
LAND.													
<i>East of 66° west longitude.</i>													
La Have Bank.....	22,360	276					25,400	394			5,650	70	
Western Bank.....	1,085,513	13,372			73,710	1,323	4,650	150			9,660	140	
Quebec Bank.....							6,610	99					
Grand Bank.....											4,000	74	
St. Peter's Bank.....	57,080	885	96,780	2,257									19
Cape North.....	600	9											
Cape Shore.....	26,375	646			4,510	45	280	11			4,910	55	
<i>West of 66° west longitude.</i>													
Browns Bank.....	5,700	201			1,100	28							
Georges Bank.....	2,515	32					73,970	1,752			46,625	673	
Casques Bank.....	5,510	209			3,135	30	53,417	1,019			119,970	2,007	
Jeffreys Ledge.....	88,438	4,513			30,395	687	41,758	2,010			221,052	5,199	
South Channel.....	2,001,614	27,222	2,910	146	435,297	5,228	23,483	2,110			77,013	812	
Shore, general.....	1,186,191	57,562	5,126	258	100,667	3,928	497,120	15,427	528	27	1,317,223	27,230	99
Total.....	4,481,916	105,226	104,816	2,661	708,814	11,278	732,688	21,414	528	27	1,802,103	36,266	118
Grand total.....	45,109,704	1,429,986	182,816	4,256	15,261,792	327,396	5,787,117	161,066	136,698	2,810	7,241,974	173,230	131

QUANTITIES AND VALUES OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1916, SHOWN BY FISHING GROUNDS.—Continued.

Fishing grounds.	Pollock.				Cusk.				Halibut.			
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
LANDED AT BOSTON.												
<i>East of 66° west longitude.</i>												
La Have Bank.....	15,464	\$320			161,687	\$3,076			18,958	\$2,904		
Western Bank.....	96,269	2,870			7,105	142			30,219	4,339		
Quereau Bank.....	420	4			18,500	309			53,075	5,066		
Green Bank.....									50,000	4,000		
Grand Bank.....									183,000	17,200		
Burgco Bank.....									50,000	5,500		
Cape Shore.....	43,485	1,285			139,552	3,144			17,420	2,544		
Gulf of St. Lawrence.....									55,000	5,500		
St. Anns Bank.....	425	6							168	76		
<i>West of 66° west longitude.</i>												
Browns Bank.....	272,912	7,633			1,612,334	32,561			197,570	33,786		
Georges Bank.....	416,647	10,494			208,714	4,971			273,703	31,263		
Cashes Bank.....	17,280	461			117,598	2,222			1,722	243		
Clark Bank.....	200	4							3,416	471		
Fippennes Bank.....	4,405	112			79,303	1,485			1,824	107		
Middle Bank.....	23,478	832			42,172	1,124			1,853	407		
Jefferys Lodge.....	1,397,417	41,022			444,829	10,426			13,311	2,979		
South Channel.....	367,970	10,381			1,900	62			18,517	1,773		
Nantucket Shoals.....	42,938	1,280			236,327	5,592			102,697	14,733		
Off Highland Light.....	802,760	20			2,840	73			37,771	4,683		
Bay of Fundy.....	2,410	64			515	15			77	9		
Seal Island.....	2,800	144			53,300	1,487			39,877	6,884		
Shore, general.....	7,637				33,230	682			111	32		
					71,638	1,653			1,148	280		
					421,333	8,970			8,415	1,410		
Total.....	3,792,169	108,797			3,657,429	77,702			1,111,955	144,128		
LANDED AT GLOUCESTER.												
<i>East of 66° west longitude.</i>												
La Have Bank.....	5,625	72			99,345	1,417			65,059	6,269		
Western Bank.....	55,985	662			191,819	2,024			173,773	17,089		
Quereau Bank.....	52,757	684			408,971	7,995			271,925	26,389		
Western Bank.....												
		</										

Misaine Bank.....	249	1,250	31	570	10	500	10	22,734	3,011	.....
Green Bank.....	24	16,010	344	45,220	737	5,310	129	474,898	45,272	14,807
Grand Bank.....	6	.....	.....	1,575	30	155	5	34,611	4,297	1,107
St. Peters Bank.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,945
Burgo Bank.....	2	.....	.....	4,400	82	1,580	31	98,445	8,469	3,840
Bacalaru Bank.....	8	3,260	66	980	15	835	9	19,225	1,743	3,122
Cape North.....	193	3,033	25	182,430	2,570	2,025	108	35,104	3,802	1,845
Cape Shore.....	603	3,350	68	6,335	101	105	2	56,893	5,638	.....
Gulf of St. Lawrence.....	1	120	3	100	12	1,650	40	23,905	2,719	1,008
St. Ann's Bank.....	5	165	3	7,480	114	180	5	234,566	31,807	.....
The Gully.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Labrador Coast.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	42,975
<i>West of 66° west longitude.</i>										
Browns Bank.....	449	.....	.....	144,838	1,848	.....	.....	21,226	1,776	.....
Georges Bank.....	1,322	31,010	675	188,758	2,568	2,705	69	118,181	11,046	315
South Channel.....	12	.....	.....	220	3	.....	.....	.....	.....	26
Nantucket Shoals.....	46	4,297	85	470	6	5,780	141	.....	.....	.....
Seal Island.....	15	.....	.....	104,245	1,299	.....	.....	51,447	5,938	.....
Shore, general.....	232,261	313	5	66,110	841	94	2	.....	.....	.....
Total.....	10,117,193	78,168	1,635	1,553,926	22,263	34,000	869	1,686,252	175,285	95,244
LANDED AT PORTLAND.										
<i>East of 66° west longitude.</i>										
La Have Bank.....	43	720	22	17,030	271	.....	.....	77,074	8,006	.....
Western Bank.....	557	.....	.....	17,190	250	.....	.....	49,558	4,560	.....
Quereau Bank.....	3	.....	.....	670	10	.....	.....	34,792	3,942	.....
Green Bank.....	.....	.....	.....	.....	.....	.....	.....	15,315	1,789	.....
Grand Bank.....	.....	.....	.....	.....	.....	.....	.....	144,899	16,079	.....
St. Peters Bank.....	.....	580	13	.....	.....	.....	.....	.....	.....	.....
Bacaleu Bank.....	.....	.....	.....	.....	.....	.....	.....	12,937	1,493	.....
Cape North.....	.....	.....	.....	1,380	24	.....	.....	40,472	2,800	.....
Cape Shore.....	15	.....	.....	.....	.....	.....	.....	42,796	6,081	.....
The Gully.....	.....	.....	.....	.....	.....	.....	.....	43,121	4,944	.....
<i>West of 66° west longitude.</i>										
Browns Bank.....	16	.....	.....	.....	.....	.....	.....	13,762	1,769	.....
Georges Bank.....	22	2,595	.....	70,345	50	.....	.....	42,297	4,380	.....
Cashes Bank.....	368	.....	.....	142,961	1,351	6,335	47	69	82	.....
Jeffrey's ledge.....	623	.....	.....	.....	2,867	.....	.....	2,432	283	.....
South Channel.....	94	.....	.....	.....	.....	.....	.....	3,445	176	.....
Shore, general.....	34,980	21,675	368	533,001	13,018	11,435	119	11,723	1,278	.....
Total.....	1,593,125	36,721	403	805,172	18,450	17,770	106	535,314	57,662	.....
Grand total.....	15,502,487	101,143	2,038	6,016,527	118,415	51,770	1,035	3,363,521	377,075	8,510



LANDED AT PORTLAND.															
<i>West of 66° west longitude.</i>															
Shore, general.....	213, 873	11, 792	.....	.....	.....	217, 124	.....	10, 953	1, 055	108	.....	322, 580	15, 767	7, 370	253
Total.....	213, 873	11, 792	.....	.....	.....	217, 124	.....	10, 953	1, 055	108	.....	322, 580	15, 767	7, 370	258
Grand total.....	5, 750, 103	354, 184	.....	1, 813, 096	149, 476	3, 438, 381	.....	196, 879	2, 283, 986	207, 447	.....	1, 643, 147	76, 476	947, 666	64, 826

Fishing grounds.				Miscellaneous.				Total.				Grand total.			
LANDED AT BOSTON.															
<i>East of 66° west longitude.</i>															
				Fresh.		Salted.		Fresh.		Salted.					
				Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
La Have Bank.....	.....	.....	.....	15, 844	\$944	.....	.....	.....	.....	.....	.....	.....	.....	838, 202	\$23, 072
Western Bank.....	.....	.....	.....	54, 418	2, 164	.....	.....	5, 332, 007	172, 651	.....	.....	5, 332, 007	172, 651	5, 332, 007	172, 651
Quebec Bank.....	.....	.....	.....	225	32	.....	.....	172, 467	8, 382	.....	.....	172, 467	8, 382	172, 467	8, 382
Green Bank.....	.....	.....	.....	.....	.....	.....	.....	70, 000	5, 000	.....	.....	70, 000	5, 000	70, 000	5, 000
Grand Bank.....	.....	.....	.....	.....	.....	.....	.....	183, 000	17, 200	.....	.....	183, 000	17, 200	183, 000	17, 200
Bregeo Bank.....	.....	.....	.....	.....	.....	.....	.....	50, 000	5, 500	.....	.....	50, 000	5, 500	50, 000	5, 500
Off Newfoundland.....	.....	.....	.....	9, 804, 400	24, 132	.....	.....	804, 400	24, 132	.....	.....	804, 400	24, 132	804, 400	24, 132
Cape Shore.....	.....	.....	.....	151, 895	21, 532	.....	.....	4, 779, 522	200, 185	.....	.....	4, 779, 522	200, 185	4, 779, 522	200, 185
Gulf of St. Lawrence.....	.....	.....	.....	.....	.....	.....	.....	55, 000	5, 500	.....	.....	55, 000	5, 500	55, 000	5, 500
St. Ann's Bank.....	.....	.....	.....	.....	.....	.....	.....	211, 513	7, 229	.....	.....	211, 513	7, 229	211, 513	7, 229
<i>West of 66° west longitude.</i>															
Browns Bank.....	.....	.....	.....	103, 163	3, 138	.....	.....	13, 125, 441	419, 131	.....	.....	13, 125, 441	419, 131	13, 125, 441	419, 131
Georges Bank.....	.....	.....	.....	1, 841, 303	222, 794	.....	.....	14, 352, 452	746, 850	.....	.....	14, 352, 452	746, 850	14, 352, 452	746, 850
Cashes Bank.....	.....	.....	.....	18, 420	446	.....	.....	492, 935	14, 543	.....	.....	492, 935	14, 543	492, 935	14, 543
Clark Bank.....	.....	.....	.....	297	44	.....	.....	7, 513	618	.....	.....	7, 513	618	7, 513	618
Flippens Bank.....	.....	.....	.....	11, 730	220	.....	.....	336, 361	7, 761	.....	.....	336, 361	7, 761	336, 361	7, 761
Middle Bank.....	.....	.....	.....	35, 207	1, 370	.....	.....	1, 311, 539	66, 183	.....	.....	1, 311, 539	66, 183	1, 311, 539	66, 183
Jeffreys Ledge.....	.....	.....	.....	230, 692	6, 006	.....	.....	6, 436, 661	247, 486	.....	.....	6, 436, 661	247, 486	6, 436, 661	247, 486
Ipswich Bay.....	.....	.....	.....	831	16	.....	.....	183, 075	7, 074	.....	.....	183, 075	7, 074	183, 075	7, 074
South Channel.....	.....	.....	.....	1, 597, 656	47, 832	.....	.....	24, 583, 383	756, 796	.....	.....	24, 583, 383	756, 796	24, 583, 383	756, 796
Nantucket Shoals.....	.....	.....	.....	60, 548	930	.....	.....	1, 814, 947	68, 567	.....	.....	1, 814, 947	68, 567	1, 814, 947	68, 567

*a* Herring. Other items under "Miscellaneous" include bluebacks, 1,882,457 pounds, value \$10,605; bluefish, 48,024 pounds, value \$530; butterfish, 185,675 pounds, value \$9,420; catfish or wolffish, 216,763 pounds, value \$4,629; flounders, 1,297,886 pounds, value \$6,684; grayfish, 377,501 pounds, value \$2,194; herring, 7,301,005 pounds, value \$66,646; horse mackerel, 7,175 pounds, value \$176; redfish, 117,222 pounds, value \$1,942; salmon, 455 pounds, value \$61; shad, 444,863 pounds, value \$20,615; sharks, 12,959 pounds, value \$268; skates, 184,556 pounds, value \$2,767; snell, 58,267 pounds, value \$4,153; sturgeon, 2,221 pounds, value \$144; swordfish, 1,773,452 pounds, value \$238,346; tilefish, 873,142 pounds, value \$24,295; lobster, 6,978 pounds, value \$1,793; squid, 80 pounds, value \$1; live fish, 1,110,408 pounds, value \$15,600; sounds, 105,825 pounds, value \$5,881; spawn, 93,649 pounds, value \$7,288; cod cheeks, 313 pounds, value \$13; tongues, fresh, 3,520 pounds, value \$114; and tongues, salted, 40 pounds, value \$2.

QUANTITIES AND VALUES OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1916, SHOWN BY FISHING GROUNDS—Continued.

Fishing grounds.	Miscellaneous.				Total.				Grand total.	
	Fresh.		Salted.		Fresh.		Salted.			
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.		
LANDED AT BOSTON—continued.										
West of 66° west longitude—Continued.										
Off Highland Light.....	5,800	\$56			43,181	\$1,419			43,181	\$1,419
Off Chatham.....	493,507	9,466			14,087,116	478,280			14,087,116	478,985
Off Race Point.....	8,000	120			107,250	8,229			107,250	8,229
Bay of Fundy.....	7,200	166			163,786	4,066			163,786	4,066
Seal Island.....	2,945	51			290,031	10,212			290,031	10,212
South.....	928,112	25,304			928,112	25,304			928,112	25,304
Shore, general.....	340,850	8,407			7,494,714	364,294	47,000	4,316	7,541,714	368,610
Total.....	6,712,473	375,230			98,254,638	3,695,994	76,400	6,371	98,331,038	3,702,365
LANDED AT GLOUCESTER.										
East of 66° west longitude.										
La Have Bank.....					561,154	13,707	38,347	1,589	599,501	15,296
Western Bank.....					3,901,536	90,697	152,376	5,957	4,053,912	96,654
Quebec Bank.....					7,849,177	182,700	979,002	44,341	8,828,179	227,041
Misaine Bank.....	260	20			373,930	6,472			373,930	6,472
Green Bank.....					88,549	4,313	48,835	2,084	137,384	6,397
Grand Bank.....	735	74			1,290,114	62,616	2,521,155	107,683	3,801,309	170,289
St. Peters Bank.....					125,076	6,629	27,000	1,400	152,076	8,029
Burgeo Bank.....					290,095	12,857	8,575	517	298,670	13,374
Bacaleu Bank.....					3,244,611	118,527	268,407	12,504	3,513,018	137,934
Off Newfoundland.....	3,244,611	118,527			1,027,315	24,215	7,400,224	188,839	10,644,835	307,366
Cape North.....					979,187	21,398	1,711,729	70,447	2,739,044	94,662
Cape Shore.....	250	25			759,522	21,253	1,727,085	46,747	3,486,607	106,409
Gulf of St. Lawrence.....					541,850	12,362	1,122,350	53,565	1,881,872	74,818
St. Arns Bank.....					317,483	33,634	50,035	2,403	359,885	14,765
The Gully.....							38,480	1,918	355,963	35,552
Labrador coast.....							56,185	5,025	56,185	5,025
West of 66° west longitude.										
Browns Bank.....					2,889,454	50,811	26,245	1,266	2,915,699	52,077
Georges Bank.....					3,429,860	79,000	1,973,351	161,067	5,403,211	240,067
Middle Bank.....					230,635	11,451	568,600	63,935	799,135	65,386

South Channel.....					267,095	3,924	267,095	3,924
Nantucket Shoals.....					102,100	102,100	1,530,549	112,698
Off Chatham.....					123,023	11,021	825,901	37,365
Seal Island.....					2,000	82	184,572	7,824
South.....					1,011,310	73,391	18,274,962	483,972
Shore, general.....					20,165,271	947,881	66,680,548	2,159,894
Total.....								
LANDED AT PORTLAND.								
<i>East of 66° west longitude.</i>								
La Have Bank.....								
Western Bank.....								
Quebec Bank.....								
Green Bank.....								
Grand Bank.....								
St. Peters Bank.....								
Bacaleu Bank.....								
Cape North.....								
Cape Shore.....								
The Gully.....								
<i>West of 66° west longitude.</i>								
Brown Bank.....								
Georges Bank.....								
Cashes Bank.....								
Jeffreys Ledge.....								
South Channel.....								
Shore, general.....								
Total.....								
Grand total.....								

a See footnote, p. 21.

QUANTITIES AND VALUES OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., BY AMERICAN FISHING VESSELS DURING THE YEAR 1916, SHOWN BY MONTHS.

Month.	Num-ber of trips.	Cod.											
		Large (10 pounds and over).				Market (under 10 and over 2½ pounds).				Scrod (1 to 2½ pounds).			
		Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
LANDED AT BOSTON.													
January.....	195	447,547	\$23,270	.....	498,444	\$13,317	.....	78,189	\$1,212	.....	.....	.....	.....
February.....	184	496,769	26,994	.....	568,061	16,725	.....	70,506	1,129	.....	.....	.....	.....
March.....	220	478,426	32,802	.....	507,323	22,337	.....	34,737	991	.....	.....	.....	.....
April.....	232	906,503	34,937	.....	856,104	22,571	.....	34,627	620	.....	.....	.....	.....
May.....	1,301,917	38,703	.....	.....	1,259,076	29,986	.....	42,521	624	.....	.....	.....	.....
June.....	261	893,493	43,001	.....	1,120,179	33,039	.....	93,910	1,328	.....	.....	.....	.....
July.....	316	669,594	39,243	.....	1,186,357	40,529	.....	105,566	1,525	.....	.....	.....	.....
August.....	371	648,315	40,050	.....	1,187,063	40,996	.....	179,070	2,848	.....	.....	.....	.....
September.....	315	643,537	37,410	.....	866,120	30,236	.....	92,546	1,557	.....	.....	.....	.....
October.....	327	448,421	30,716	.....	519,933	24,501	.....	62,444	1,400	.....	.....	.....	.....
November.....	234	316,698	21,558	.....	472,030	19,133	.....	143,760	3,198	.....	.....	.....	.....
December.....	190	338,591	21,042	.....	562,253	21,380	.....	134,101	3,173	.....	.....	.....	.....
Total.....	3,089	7,649,811	389,726	.....	9,529,973	315,550	.....	1,071,917	19,605	.....	.....	.....	.....
LANDED AT GLOUCESTER.													
January.....	197	122,407	3,597	.....	118,225	1,773	.....	4,890	37	.....	.....	.....	.....
February.....	103	133,372	6,344	.....	63,700	772	.....	6,555	49	.....	.....	.....	\$29
March.....	174	196,295	11,976	.....	29,071	714	.....	340	3	.....	.....	.....	11
April.....	420	1,440,165	51,229	.....	531,782	11,769	.....	14,880	592	.....	.....	.....	405
May.....	457	1,871,988	49,014	.....	1,510,891	33,197	.....	18,430	743	.....	.....	.....	84
June.....	144	1,132,047	27,395	.....	1,322,235	29,478	.....	72,857	2,927	.....	.....	.....	62
July.....	158	897,686	23,723	.....	1,322,235	29,478	.....	96,480	802	.....	.....	.....	2,990
August.....	181	732,130	19,259	.....	953,370	21,681	.....	133,522	1,310	.....	.....	.....	60,435
September.....	181	522,563	14,528	.....	981,935	22,373	.....	36,751	1,009	.....	.....	.....	1,640
October.....	145	432,702	9,377	.....	635,524	15,544	.....	44,126	363	.....	.....	.....	1,331
November.....	369	159,003	7,032	.....	332,789	8,036	.....	18,380	209	.....	.....	.....	53,580
December.....	335	65,548	2,326	.....	332,789	8,036	.....	20,480	209	.....	.....	.....	45,675
				.....	59,555	1,273	.....	19,480	80	.....	.....	.....	1,599
				.....	11,640	1,509	.....	2,720	27	.....	.....	.....	1,045
				.....	44,890	1,273	.....	34,574	134	.....	.....	.....	1,513
Total.....	2,894	7,725,906	225,800	.....	9,446,695	315,550	.....	1,071,917	19,605	.....	.....	.....	8,739



LANDED AT PORTLAND.

LANDED AT FORTLAND.									
January.....	140	77,741	4,366	104,895	3,552	30,016	321		
February.....	171	123,939	6,806	95,148	3,255	26,535	346		
March.....	378	274,279	16,589	208,906	8,524	24,249	549		
April.....	346	298,974	10,485	238,048	5,720	17,817	205		
May.....	301	238,580	7,277	187,839	3,823	12,714	134		
June.....	350	53,094	1,592	13,270	318	3,050	29		
July.....	195	29,684	1,106	46,474	1,009	3,075	35		
August.....	148	26,046	1,441	35,987	730	4,493	37		
September.....	145	46,097	2,133	42,004	1,059	4,591	60		
October.....	227	78,052	9,732	52,926	2,700	15,313	231		
November.....	255	101,673	8,829	98,233	3,399	37,399	501		
December.....	336	72,164	4,699	136,788	5,711	76,176	1,464		
Total.....	2,992	1,440,323	72,569	1,260,523	40,240	255,428	3,912		
Grand total.....	8,945	16,816,040	688,095	17,470,503	503,899	1,706,546	8,883		
Grounds E. of 66° W. long.....	502	6,214,476	178,935	6,833,933	161,363	489,707	5,631		
Grounds W. of 66° W. long.....	8,353	10,601,564	509,160	10,636,570	342,536	1,216,839	20,944		
Landed at Boston in 1915 <sup>a</sup> .....	3,772	7,181,682	317,507	11,928,214	283,911	1,109,757	14,857		
Landed at Gloucester in 1915 <sup>a</sup> .....	3,472	7,386,852	170,397	6,225,910	100,123	255,709	2,057		
					3,994,245		292,908		
					106,994		9,995		
					2,607,010		238		
					220,258		14		
					10,296		7,662		
					1,109,757		8,883		
					1,255,709		308,925		
					134,725		1,706,546		
					26,575		28,575		
					3,912		5,090		
					5,200		141		

## Haddock.

Month.	Haddock.				Hake.			
	Large (over 2½ pounds).		Scrod (1 to 2½ pounds).		Large (6 pounds and over).		Small (under 6 pounds).	
	Fresh.	Salted.	Fresh.	Salted.	Fresh.	Salted.	Fresh.	Salted.
LANDED AT BOSTON.	<i>Pounds.</i>	<i>Value.</i>	<i>Pounds.</i>	<i>Value.</i>	<i>Pounds.</i>	<i>Value.</i>	<i>Pounds.</i>	<i>Value.</i>
January.....	2,614, 870	\$112, 239	715, 491	\$21, 580	113, 607	\$5, 744	239, 598	\$8, 306
February.....	3,574, 772	130, 650	1, 369, 415	31, 260	46, 739	3, 122	107, 519	4, 100
March.....	3, 515, 847	174, 584	1, 130, 962	42, 881	48, 980	5, 350	108, 810	6, 371
April.....	4, 371, 590	94, 314	1, 161, 946	15, 393	119, 393	5, 491	103, 198	10, 710
May.....	2, 410, 927	62, 873	1, 156, 134	17, 525	244, 439	6, 532	798, 417	11, 176
June.....	2, 028, 340	70, 105	1, 364, 695	26, 191	201, 035	7, 378	402, 367	8, 656
July.....	2, 134, 437	59, 595	1, 262, 190	16, 790	201, 035	6, 254	402, 367	8, 656
August.....	3, 072, 192	79, 674	1, 464, 448	22, 639	298, 051	8, 974	522, 506	11, 093
September.....	3, 215, 211	85, 459	1, 355, 467	20, 922	386, 023	11, 411	572, 765	12, 098
October.....	3, 046, 875	118, 774	1, 231, 247	33, 306	242, 384	11, 524	772, 715	21, 969
November.....	2, 184, 829	103, 177	1, 231, 247	33, 306	194, 378	8, 281	604, 825	17, 697
December.....	2, 181, 675	124, 169	953, 371	36, 829	107, 713	6, 510	387, 909	15, 594
Total.....	34, 351, 565	1, 215, 663	14, 199, 920	311, 844	2, 233, 257	84, 591	5, 420, 587	136, 345

Statistics of the fishery products landed at Portland in 1915 are not available for the entire year, and are therefore not shown in this statement.



Month.	Pollock.				Cusk.				Halibut.			
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Grounds E. of 66° W. long.....	164,167	3,617	1,233,710	28,518	300	8	2,180,546	38,450	135,947	2,779	318,629	7,789
Grounds W. of 66° W. long.....	18,649	639	14,023,082	298,878	1,180	29	3,606,571	122,616	751	31	6,923,345	165,441
Landed at Boston in 1915.....	.....	.....	11,804,369	166,064	.....	.....	2,842,605	93,190	5,000	75	6,820,297	119,954
Landed at Gloucester in 1915.....	130,594	2,361	1,000,575	7,728	.....	.....	4,926,412	64,326	295,625	4,932	.....	.....
LANDED AT BOSTON.												
January.....	94,398	\$2,956	.....	.....	172,689	\$4,225	.....	.....	10,935	\$3,702	.....	.....
February.....	90,355	3,560	.....	.....	335,009	7,321	.....	.....	36,785	7,104	.....	.....
March.....	91,364	4,199	.....	.....	363,843	10,654	.....	.....	36,759	9,390	.....	.....
April.....	163,485	4,054	.....	.....	869,445	14,088	.....	.....	103,043	16,398	.....	.....
May.....	217,788	4,284	.....	.....	470,311	7,568	.....	.....	128,985	16,024	.....	.....
June.....	263,596	7,880	.....	.....	133,628	2,902	.....	.....	253,905	27,880	.....	.....
July.....	398,584	12,678	.....	.....	200,067	4,154	.....	.....	165,766	16,815	.....	.....
August.....	631,117	19,083	.....	.....	186,167	3,643	.....	.....	211,714	21,206	.....	.....
September.....	725,832	18,692	.....	.....	178,889	3,906	.....	.....	123,107	13,287	.....	.....
October.....	647,157	18,563	.....	.....	243,033	6,329	.....	.....	32,273	5,473	.....	.....
November.....	277,223	7,404	.....	.....	299,069	7,386	.....	.....	16,178	4,009	.....	.....
December.....	191,270	5,444	.....	.....	205,279	5,526	.....	.....	11,105	2,840	.....	.....
Total.....	3,792,169	108,797	.....	.....	3,657,429	77,702	.....	.....	1,141,955	144,128	.....	.....
LANDED AT GLOUCESTER.												
January.....	753,418	27,289	.....	.....	.....	.....	.....	.....	25,600	3,785	.....	.....
February.....	68,010	3,296	180	\$3	.....	.....	.....	.....	135,848	16,283	.....	.....
March.....	46,807	2,353	1,500	26	.....	.....	.....	.....	92,757	11,553	.....	.....
April.....	273,685	8,283	4,640	93	.....	.....	.....	.....	206,880	27,440	.....	.....
May.....	940,821	16,886	5,888	183	78,565	1,001	.....	.....	218,306	20,196	.....	.....
June.....	327,255	3,959	20,980	397	328,030	4,201	.....	.....	335,334	31,465	.....	.....
July.....	51,431	370	25,667	495	169,730	2,247	.....	.....	173,400	16,465	.....	.....
August.....	28,023	370	4,013	77	338,540	4,962	.....	.....	8,846	8,846	.....	.....
September.....	59,730	885	5,680	126	311,599	4,782	.....	.....	138	18,078	.....	.....
October.....	120,884	3,812	5,635	120	181,727	2,835	.....	.....	164,411	14,487	.....	.....
November.....	3,783,668	77,589	16	16	131,970	2,041	.....	.....	85	86,485	.....	.....
December.....	3,663,461	90,756	3,330	99	.....	.....	.....	.....	112	35,492	.....	.....
Total.....	10,117,193	236,060	78,168	1,635	1,553,926	22,263	.....	.....	1,686,252	175,285	.....	.....
							34,000	869		95,244		8,510



August.....	1,320,515	101,880	.....	280,662	16,944	.....	170,199	11,514	.....
September.....	839,178	56,940	.....	304,533	16,582	.....	24,158	1,630	.....
October.....	727,455	57,763	.....	904,224	70,262	.....	109,754	6,994	8,000
November.....	416,072	27,851	.....	326,245	21,631	.....	.....	.....	8,000
Total.....	5,191,392	327,874	20,000	2,341,095	146,569	47,800	891,095	42,370	8,000
LANDED AT GLOUCESTER.									
May.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
June.....	22,380	.....	600	.....	.....	.....	.....	.....	.....
July.....	56,803	2,931	466,000	32,101	.....	.....	.....	.....	1,400
August.....	28,430	1,275	109,800	8,784	106,155	.....	16,930	54	79,290
September.....	212,935	8,255	319,200	31,842	548,049	4,999	322,915	8,415	772,556
October.....	24,280	1,497	645,066	58,234	207,422	25,353	1,204,843	52,704	34,550
November.....	.....	.....	282,400	17,132	.....	7,954	507,373	2,107	43,600
Total.....	344,838	14,518	1,823,066	148,126	880,162	39,357	2,235,131	203,178	931,696
LANDED AT PORTLAND.									
June.....	2,062	125	.....	.....	.....	.....	.....	.....	.....
July.....	6,806	595	.....	.....	.....	.....	.....	.....	.....
August.....	791	36	.....	.....	.....	.....	.....	.....	.....
September.....	174,294	8,670	.....	.....	.....	.....	.....	.....	.....
October.....	28,875	2,152	.....	.....	.....	.....	.....	.....	.....
November.....	955	124	.....	.....	.....	.....	.....	.....	.....
Total.....	213,873	11,792	.....	.....	.....	.....	.....	.....	.....
Grand total.....	5,750,103	354,184	1,843,066	149,476	3,438,381	196,879	2,283,986	207,447	7,370
Grounds E. of 66° W. long.....	874,454	40,821	522,800	35,924	186,877	6,872	118,200	7,977	770
Grounds W. of 66° W. long.....	4,875,649	313,363	1,320,266	113,552	3,251,504	190,007	2,165,786	199,470	75,706
Landed at Boston in 1915.....	638,888	63,851	145,898	6,835	831,391	72,715	3,839,104	168,782	265,013
Landed at Gloucester in 1915.....	56,125	3,870	869,200	41,534	149,134	6,797	67,700	5,012	2,140,421
									64,826
									11,049
									161,646

QUANTITIES AND VALUES OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., BY AMERICAN FISHING VESSELS DURING THE YEAR 1916, SHOWN BY MONTHS—Continued.

Month.	Miscellaneous <sup>a</sup>				Total.		Grand total.			
	Fresh.		Salted.		Fresh.		Salted.			
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
LANDED AT BOSTON.										
January.....	248,563	\$8,002	.....	.....	5,230,841	\$204,893	.....	.....	5,230,841	\$204,893
February.....	715,017	23,515	.....	.....	7,411,008	255,890	.....	.....	7,411,008	255,890
March.....	85,210	5,342	.....	.....	6,410,470	313,101	.....	.....	6,410,470	313,101
April.....	115,824	2,974	.....	.....	9,300,268	221,750	.....	.....	9,300,268	221,750
May.....	317,278	6,016	.....	.....	8,274,376	201,717	.....	.....	8,274,376	201,717
June.....	465,689	11,335	.....	.....	8,899,789	303,375	.....	.....	8,899,789	303,375
July.....	1,360,675	113,066	.....	.....	9,406,060	376,997	20,000	\$1,350	9,416,060	377,702
August.....	1,230,249	106,570	.....	.....	11,402,298	487,116	.....	.....	11,402,298	487,116
September.....	817,032	47,257	.....	.....	10,244,309	357,787	38,400	3,456	10,282,709	361,243
October.....	467,771	19,347	.....	.....	9,471,726	426,218	8,600	3,860	9,480,326	427,078
November.....	651,640	21,314	.....	.....	6,892,701	294,241	.....	.....	6,892,701	294,241
December.....	237,525	10,402	.....	.....	5,310,792	252,909	.....	.....	5,310,792	252,909
Total.....	6,712,473	375,230	.....	.....	98,254,638	3,695,994	76,400	6,371	98,331,038	3,702,365
LANDED AT GLOUCESTER.										
January.....	1,729,111	65,484	.....	.....	2,790,585	104,242	.....	.....	2,790,585	104,242
February.....	4,403,000	90,105	.....	.....	1,833,465	77,265	.....	.....	2,787,953	101,540
March.....	112,500	3,038	.....	.....	3,627,859	33,814	381,896	9,806	1,099,785	43,620
April.....	20,000	508	.....	.....	124,094	124,094	128,841	6,968	3,758,613	130,572
May.....	812,330	8,257	.....	.....	102,912	102,912	206,105	9,205	7,885,845	172,117
June.....	569,360	5,600	.....	.....	7,691,178	112,813	2,742,850	131,308	7,094,028	244,121
July.....	432,225	2,710	.....	.....	3,856,660	95,409	2,080,222	167,702	6,966,907	263,111
August.....	594,196	3,873	.....	.....	2,367,382	126,382	2,539,003	203,799	8,339,163	330,181
September.....	915,021	5,805	.....	.....	4,570,760	103,917	2,007,916	146,566	6,882,068	252,483
October.....	472,921	3,760	.....	.....	2,268,968	53,163	1,030,961	54,704	3,299,629	107,867
November.....	257,919	11,291	.....	.....	4,679,950	117,760	511,359	27,855	5,191,309	145,615
December.....	.....	.....	.....	.....	3,862,133	99,732	1,702,968	52,511	5,564,101	152,243
Total.....	7,318,583	160,173	.....	.....	46,515,277	1,212,013	20,165,271	947,881	66,680,548	2,159,894
LANDED AT PORTLAND.										
January.....	5,195	54	.....	.....	676,496	26,544	.....	.....	683,566	26,861
February.....	11,115	125	.....	.....	676,878	28,356	7,070	317	678,523	28,392
March.....	33,391	870	40	2	1,234,890	62,653	1,645	36	1,244,913	62,919
April.....	11,051	221	.....	.....	1,665,919	45,376	15,655	266	1,681,574	45,510
May.....	1,096,103	10,376	.....	.....	3,582,915	54,973	9,905	395	3,592,820	55,369
June.....	3,965,313	34,481	.....	.....	4,695,803	49,719	41,900	1,721	4,737,703	51,440

July.....	494,500	8,267	.....	1,810,991	37,923	340	12	1,811,331	37,935
August.....	228,252	6,267	.....	1,200,360	30,457	6,090	167	1,215,450	30,624
September.....	124,328	3,674	.....	2,044,574	61,458	159,030	4,675	2,203,604	66,133
October.....	112,412	2,804	.....	1,142,597	41,494	5,882	208	1,148,479	44,702
November.....	58,441	2,202	.....	962,755	36,744	3,520	37	966,275	36,781
December.....	42,310	2,090	.....	848,216	31,974	385	7	848,601	34,981
Total.....	6,182,411	71,421	40	20,551,394	513,671	261,445	7,976	20,812,839	521,647
Grand total.....	20,213,467	606,824	7,223,264	165,321,309	5,421,678	20,563,116	962,228	185,824,425	6,383,906
Grounds E. of 66° W. long.....	4,286,552	167,750	183,344	36,008,367	1,155,585	15,356,965	552,319	51,365,332	1,707,904
Grounds W. of 66° W. long.....	15,926,915	439,074	40	120,312,942	4,266,093	5,146,151	400,900	131,469,093	5,676,002
Landed at Boston in 1915.....	5,809,344	314,113	.....	97,397,285	2,888,354	5,502,202	22,860	97,899,487	2,911,314
Landed at Gloucester in 1915.....	4,649,569	84,752	8,931,550	40,677,980	1,012,279	24,018,261	814,324	73,696,241	1,826,603

<sup>a</sup> Includes herring from Newfoundland, 4,049,011 pounds frozen, value, \$142,650, and 7,223,224 pounds salted, value, \$183,344.

The principal source of supply for the large quantities of fish landed by American fishing vessels at Boston and Gloucester, Mass., and Portland, Me., is the fishing grounds lying off the coast of the United States. In the calendar year 1916, 72.10 per cent of the quantity and 72.96 per cent of the value of the catch landed by the American fishing fleet at these three ports were taken from these grounds. Of the remainder, 9.06 per cent of the quantity and 9.34 per cent of the value were taken from fishing banks off the coast of Newfoundland, 18.80 per cent of the quantity and 17.61 per cent of the value from grounds off the Canadian Provinces, and less than 1 per cent of both the quantity and value from the coast of Labrador. Herring from Newfoundland constituted 6.06 per cent of the quantity and 5.10 per cent of the value of the fishery products landed at these ports during the year. The herring were taken on the treaty coasts of Newfoundland, but cod and other species from that region were obtained chiefly from fishing banks on the high seas. All fish caught by American fishing vessels off the Canadian Provinces were from offshore fishing grounds. The catch for each of these regions is given in detail in the following table:

QUANTITY AND VALUE OF FISH LANDED BY AMERICAN FISHING VESSELS AT BOSTON AND GLOUCESTER, MASS., AND PORTLAND, ME., IN 1916, FROM GROUNDS OFF THE COAST OF THE UNITED STATES, NEWFOUNDLAND, AND CANADIAN PROVINCES.

Species.	United States.		Newfoundland. <sup>a</sup>		Canadian Provinces.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cod:								
Fresh.....	22,358,873	\$869,195	827,672	\$21,114	12,806,544	\$328,350	35,993,089	\$1,218,569
Salted.....	603,219	29,724	3,021,449	129,726	4,004,775	178,863	7,629,473	338,313
Haddock:								
Fresh.....	49,843,838	1,488,572	105,265	1,504	10,422,393	267,306	60,371,496	1,757,382
Salted.....	19,829	668	110,639	2,534	53,828	1,091	184,296	4,293
Hake:								
Fresh.....	10,520,206	287,772	265,974	4,403	2,242,911	42,121	13,029,091	334,296
Salted.....	5,356	130	64,290	1,349	73,562	1,465	143,208	2,944
Pollock:								
Fresh.....	15,125,113	374,361	5,350	73	372,024	7,144	15,502,487	381,578
Salted.....	57,295	1,133	17,840	388	26,008	517	101,143	2,038
Cusk:								
Fresh.....	4,428,815	92,539	51,765	860	1,535,947	25,016	6,016,527	118,415
Salted.....	26,349	378	7,545	175	17,876	482	51,770	1,035
Halibut:								
Fresh.....	896,724	117,509	1,084,749	107,110	1,382,048	152,456	3,363,521	377,075
Salted.....	315	26	66,649	6,212	28,280	2,272	95,244	8,510
Mackerel:								
Fresh.....	9,740,800	579,076	-----	-----	1,090,831	48,463	10,831,631	627,539
Salted.....	4,433,718	377,848	-----	-----	641,000	43,901	5,074,718	421,749
Herring:								
Fresh.....	7,360,705	66,641	4,049,011	142,659	300	5	11,410,016	209,305
Salted.....	-----	-----	7,223,224	183,344	-----	-----	7,223,224	183,344
Swordfish:								
Fresh.....	1,647,908	217,867	735	74	123,669	20,338	1,772,312	238,279
Tilefish:								
Fresh.....	873,142	24,295	-----	-----	-----	-----	873,142	24,295
Miscellaneous:								
Fresh.....	6,042,215	130,220	360	22	115,422	4,703	6,157,997	134,945
Salted.....	40	2	-----	-----	-----	-----	40	2
Total.....	133,984,490	4,657,866	16,902,517	601,547	34,937,418	1,124,493	185,824,425	6,383,906

<sup>a</sup> Includes 13,210 pounds of salted cod, valued at \$576, and 42,975 pounds of salted halibut, valued at \$4,449, from the Labrador coast.

*Cod.*—In 1916 there were 19 vessels employed in the salt bank fishery and 96 in the market fishery landing their fares at Boston, Gloucester, and Portland. Considerable quantities of cod were brought in also by vessels operating on the shore grounds. The total



quantity of cod landed was 43,622,562 pounds, valued at \$1,556,882, of which 35,993,089 pounds, valued at \$1,218,569 were fresh, and 7,629,473 pounds, valued at \$338,313, were salted.

*Haddock.*—The haddock is the most important of the fishes taken in these fisheries. The quantity landed was 60,555,792 pounds, valued at \$1,761,675, nearly all in a fresh condition, only 184,296 pounds, valued at \$4,293, being salted.

*Hake.*—The year's yield of hake amounted to 13,172,299 pounds, valued at \$337,240. The entire catch was landed fresh with the exception of 143,208 pounds, valued at \$2,944, which were salted.

*Pollock.*—The pollock fishery was in a prosperous condition in 1916, and the catch landed at Boston and Gloucester exceeded that of the previous year by 791,577 pounds in quantity and \$93,234 in value. The total yield for Boston, Gloucester, and Portland was 15,603,630 pounds, valued at \$383,616. This quantity was landed fresh except 101,143 pounds, valued at \$2,038, which were salted.

*Cusk.*—The catch of cusk was 6,068,297 pounds, valued at \$119,450, of which 51,770 pounds, valued at \$1,035, were salted.

*Halibut.*—The halibut fishery on the Atlantic has varied but little during the past few years. The catch in 1916 was 3,458,765 pounds, valued at \$385,585, all of which was landed fresh except 95,244 pounds, valued at \$8,510, salted. The quantity landed at Boston and Gloucester declined from 3,870,685 pounds in 1915 to 2,923,451 pounds in 1916, but in the latter year there was an increase of \$4,627 in the value.

*Mackerel.*—There is reason to believe that the abundance of mackerel is increasing, and there is no reason why the large catches of former years may not be repeated. The yield of fresh mackerel by the American fleet in 1916 was 102,420 barrels, compared with 71,564 barrels the previous year, an increase of 30,856 barrels. The output of salted mackerel was 19,554 barrels, compared with 19,691 barrels the previous year, a decrease of 137 barrels. The quantity landed at Boston, Gloucester, and Portland during the year was 15,906,349 pounds, valued at \$1,049,288, of which 10,831,631 pounds, valued at \$627,539, were fresh, and 5,074,718 pounds, valued at \$421,749, were salted.

In 1917 up to June 30 the catch of fresh mackerel was 38,947 barrels and of salted mackerel 7,131 barrels, as against 43,169 barrels fresh and 4,468 barrels salted for the previous year to the same date. The mackerel fishery in the spring of 1917 was interrupted owing to a strike among the fishermen at the beginning of the season. The seining fleet was delayed in sailing, and the season was a failure so far as the seiners were concerned. The gill netters had a very successful season, and the fishermen made the largest shares for many years. During the season of six weeks some of the fishermen shared \$1,000 each, and a considerable number shared \$500 each. The fleet numbered about 30 sail of seiners in the south and about 125 sail of netters, about the same number as in the previous season. The fish taken were of mixed sizes, weighing from about  $1\frac{1}{4}$  to  $3\frac{1}{2}$  pounds each, and brought from 8 to 14 cents a pound, according to market conditions. Up to the latter part of May the catch was only about one-third that of the previous season. The first fare of mackerel of the season of 1917, amounting to 5 barrels, was landed

April 25 at Atlantic City, N. J.; these fish weighed  $1\frac{1}{2}$  pounds each and sold in New York at 22 cents a pound. The Cape Shore fleet numbered about 32 sail, or about 8 more than in the previous year. These vessels were very successful, and more vessels than ever before made second trips, and one vessel made three trips.

*Swordfish.*—The catch of swordfish landed at Boston, Gloucester, and Portland amounted to 1,772,312 pounds, valued at \$238,279. The swordfish fleet was not so large as in the previous year, and the receipts at Boston and Gloucester declined 483,345 pounds in quantity but increased \$14,743 in value.

#### FISHERIES OF THE PACIFIC COAST STATES.

The Bureau has completed a canvass of the commercial fisheries of the Pacific Coast States for the calendar year 1915, and a bulletin embodying the results of the canvass has been prepared for distribution to the trade. The statistical agents of the Bureau visited every fishing community and obtained data by personal interviews with fishermen and fish handlers and by personal examination of all available records. The last general canvass of the fisheries of this region was made by the Bureau in 1904.

The number of persons engaged in the fisheries of these States was found to be 28,936; the investment in vessels, boats, fishing apparatus, shore and accessory property, and cash capital amounted to \$24,025,172; and the products aggregated 286,204,558 pounds, with a value to the fishermen of \$9,300,672. Washington ranks first among these States in the extent of its fisheries. In 1915, this State had 14,609 persons employed, an investment of \$14,133,908, and products amounting to 158,983,478 pounds, valued at \$5,317,080. California ranked second with 8,457 persons employed, an investment of \$5,827,113, and products of 92,513,457 pounds, valued at \$2,488,098. In Oregon the number of persons employed was 5,870, the investment \$4,064,151, and the products aggregated 34,707,623 pounds, valued at \$1,495,494.

The pack of canned salmon in the three States aggregated 1,961,026 cases, valued at \$9,298,566; the pack of canned tuna, all of which is put up in California, aggregated 258,427 cases, valued at \$1,517,858, and other canned articles amounted in value to \$858,907; a total of \$11,675,331.

The species taken in largest quantities were albacore or tuna, 21,049,190 pounds, valued at \$316,103; cod, 10,487,401 pounds, valued at \$343,338; halibut, 40,825,874 pounds, valued at \$2,050,709; and salmon, 131,128,934 pounds, valued at \$4,089,865.

Compared with the returns for 1904, there has been a very large increase in the fisheries of these States. The number of persons employed has increased 9,278, or 47.19 per cent; the investment \$11,185,223, or 87.11 per cent; and the output 117,604,882 pounds, or 69.75 per cent, in quantity, and \$2,619,806, or 39.21 per cent, in value. Statistics of the fisheries, including the quantity and value of canned products, of the Pacific Coast States in 1915, and comparative statistics of products for various years from 1888 to 1915, are given in the following tables:

STATISTICS OF THE FISHERIES OF THE PACIFIC COAST STATES IN 1915.  
PERSONS, VESSELS, AND EQUIPMENT ENGAGED.

REPORT OF THE COMMISSIONER OF FISHERIES.

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	Washington.		Oregon.		California.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Persons engaged.....	14,609		5,870		8,457		28,936	
Vessels fishing.....	4,472	\$2,194,660	6	\$22,650	73	\$354,375	14,635	\$2,571,685
Tonnage.....	11,363		74		3,198			
Outfit.....	140	578,825	30	3,285	18	52,791	188	634,901
Vessels transporting.....	2,213	689,248	267	84,184	184	66,500	2,664	839,932
Tonnage.....								
Outfit.....	297	68,895		11,850		5,510		86,255
Scows (5 tons and over).....	7,258	142,660			2	5,500	299	148,160
Tonnage.....					146		7,404	
Boats:								
Power.....	1,565	644,755	1,382	582,485	1,430	1,353,110	4,377	2,580,350
Sail, row, etc.....	2,631	98,015	1,264	69,805	1,187	105,216	5,082	273,036
Saïnes.....	574	280,020	75	35,125	154	28,035	803	343,180
Gill nets.....	2,883	309,309	3,877	582,740	4,103	417,846	10,863	1,309,895
Pound nets.....	444	1,100,103	39	22,700			483	1,122,803
Trammel nets.....					2,320	59,400	2,320	59,400
Parauzella nets.....					44	9,000	44	9,000
Lampara nets.....					65	29,500	65	29,500
Hoop nets.....	2,487	7,497	680	995	4,860	13,585	8,027	22,077
Dip nets.....	67	134			11	64	78	198
Reef nets.....	8	425						425
Fyke nets.....					2,485	21,640	2,485	21,640
Dag nets.....					70	2,000	70	2,000
Lines.....								2,215
Beam trawls.....	21	68,000		2,443		12,407	30	108,800
Wheels.....	2	1,815			9	400	29	22,742
Pots and traps.....	4,945	1,000	27	107,800			15,020	6,970
Dredges, tongs, rakes, etc.....		8,477	5,768	4,828	4,307	9,437		2,460
Abalone outfit.....		4,811		539		2,460		2,050
Whaling apparatus.....		2,050						
Shore and accessory property.....		7,386,709		2,083,913		2,731,390		12,202,012
Cash capital.....		546,500		448,809		545,327		1,540,636
Total.....		14,133,908		4,064,151		5,827,113		24,025,172

STATISTICS OF THE FISHERIES OF THE PACIFIC COAST STATES IN 1915—Continued.  
FRESH AND SALTED PRODUCTS, ETC.

	Washington.		Oregon.		California.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Albacore (or tuna):					a 21,024,190	\$315,622	21,024,190	\$315,622
Fresh.....					25,000	481	25,000	481
Salted.....								
Anchovies:								
Fresh.....					81,385	1,730	81,385	1,730
Salted.....					16,000	1,600	16,000	1,600
Barracuda:								
Fresh.....					3,262,646	111,690	3,262,646	111,690
Salted.....					330,000	13,180	330,000	13,180
Bonito.....					448,256	12,622	448,256	12,622
Fresh.....					350,815	6,366	350,815	6,366
Salted.....	200,000	\$4,000	50,000	\$750	517,054	24,299	600,815	11,116
Calfish.....							517,054	24,299
Cod.....								
Fresh.....	22,025	421	14,400	288			36,425	709
Salted.....	5,498,284	180,934			4,952,692	161,695	10,450,976	342,629
Croakers:					3,150	65	3,150	65
Flounders:								
Fresh.....	23,255	586	1,965	40	6,914,063	209,291	6,939,283	209,917
Salted.....					9,500	475	9,500	475
Grayfish.....							7,093,986	15,959
Hake:								
Fresh.....					221,252	1,937	221,252	1,937
Salted.....					24,000	960	24,000	960
Halibut.....							40,825,874	2,030,709
Fresh.....	40,590,705	2,041,279	235,169	9,430	73,423	3,622	40,825,874	2,030,709
Hardhead.....							73,423	3,622
Herring:								
Fresh.....					764,384	7,116	2,906,033	17,154
Salted.....	2,129,149	9,655	12,500	383	50,000	1,000	50,000	1,000
Jewfish:								
Fresh.....					116,461	1,859	116,461	1,859
Salted.....					138,000	5,020	138,000	5,020
Kingfish.....					656,003	17,362	656,003	17,362
"Lingcod":								
Fresh.....	837,110	2,812	12,870	354	570,860	14,687	1,420,840	17,853
Salted.....					3,500	175	3,500	175
Mackerel:								
Fresh.....					253,899	6,668	253,899	6,668
Salted.....					6,450	259	6,450	259
Mullet:					3,000	300	3,000	300
Fresh.....					216,755	6,057	243,465	6,910
Salted.....	14,750	493	11,930	360	15,884	449	15,884	449
Pike, Sacramento.					19,350	2,032	19,350	2,032
Pompano.....								



STATISTICS OF THE FISHERIES OF THE PACIFIC COAST STATES IN 1915—Continued.  
FRESH AND SALTED PRODUCTS, ETC.—Continued.

	Washington.		Oregon.		California.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Clams:								
Hard.....	175,744	\$12,191			63,856	\$17,583	241,600	\$29,774
Soft.....	1,200	150	22,460	\$3,041	67,160	18,107	90,820	20,288
Razor.....	372,750	56,446	77,200	10,900			449,950	67,346
Mussels.....	700	83			19,240	2,326	19,940	2,409
Oysters:								
Eastern, market.....	265,013	140,028			375,774	165,573	640,787	305,601
Native—								
Market.....	450,394	250,298	1,547	725	8,435	6,513	460,376	257,536
Seed.....	24,808	8,619					24,808	8,619
Octopus.....					32,309	2,717	32,309	2,717
Squid.....	15,000	325			6,211,325	32,626	6,226,325	32,951
Crabs.....	1,734,410	54,526	415,272	13,755	1,414,155	128,434	3,563,837	196,715
Crawfish.....			183,720	20,747			184,270	20,112
Spiny lobsters.....					892,392	130,119	892,392	130,119
Shrimp.....	386,420	18,719			298,000	5,550	684,420	24,269
Turtle.....					206	13	206	13
Whale oil.....	2,635,125	112,851					2,635,125	112,851
Whalebone.....	6,000	4,200					6,000	4,200
Other whale products.....	1,292,000	24,390					1,292,000	24,390
Sea lion.....					9,375	4,120	9,375	4,120
Kelp.....	450,000	191			5,000,000	2,500	5,450,000	2,691
Other seaweeds.....					6,799	325	6,799	325
Total.....	158,983,478	5,317,080	34,707,623	1,495,494	92,513,457	2,488,098	286,204,558	9,300,672

COMPARATIVE YIELD OF FRESH AND SALTED PRODUCTS IN YEARS SPECIFIED.<sup>c</sup>

	1888.		1892.		1895.		1899.		1904.		1908.		1915.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1888.....	23,400,292	\$890,860	25,169,266	\$1,010,843	23,313,324	\$1,091,398	71,882,882	\$2,993,101	123,116,883	\$4,826,964	123,116,883	\$4,826,964	123,116,883	\$4,826,964
1892.....	36,757,287	931,568	28,521,105	872,405	57,838,466	3,022,991	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964
1895.....	59,079,527	1,401,433	38,141,632	1,282,036	50,010,020	1,786,483	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964
1899.....	121,630,226	2,884,908	23,245,501	862,880	74,462,089	2,568,383	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964	123,116,883	4,826,964
1904.....	88,934,790	2,972,633	27,535,232	1,185,092	52,109,654	2,523,141	108,599,676	6,839,000	176,150,000	9,300,672	176,150,000	9,300,672	176,150,000	9,300,672
1908.....	100,456,000	3,513,000	28,217,000	1,356,000	47,477,000	2,488,098	286,204,558	9,300,672	286,204,558	9,300,672	286,204,558	9,300,672	286,204,558	9,300,672
1915.....	158,983,478	5,317,080	34,707,623	1,495,494	92,513,457	2,488,098	286,204,558	9,300,672	286,204,558	9,300,672	286,204,558	9,300,672	286,204,558	9,300,672

## MOLLUSKS AND WHALE OIL, IN BUSHELS AND GALLONS.

	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clams:								
Hard.....	21,968	\$12,191						\$29,774
Soft.....	120	150						21,298
Razor.....	37,275	56,446	2,246	\$3,041	6,716	18,107	44,995	67,346
Oysters:			7,720	10,900				
Eastern, market.....	37,859	140,028			53,682	165,573	91,541	305,601
Native.....								
Market.....	64,342	250,298	221	725	1,205	6,513	65,768	257,536
Seed.....	3,544	8,619					8,544	8,619
Mussels.....	70	83			1,924	2,326	1,994	2,409
W hale oil.....	351,350	112,851					351,350	112,851

CANNED PRODUCTS.<sup>d</sup>

	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Albacore (tuna).....								
Bonito.....					258,427	\$1,517,858	258,427	\$1,517,858
Salmon:					2,551	16,586	2,551	16,586
Blueback.....								
Chinook.....	91,720	\$832,394	4,510	\$24,915			96,230	957,309
Chum.....	e 178,464	1,400,220	292,765	2,246,574	19,508	109,391	490,737	3,756,185
Humpback.....	450,409	1,219,061	40,728	104,698			491,137	1,322,759
Silver.....	f 590,378	1,772,565					590,378	1,772,565
Steelhead.....	206,508	1,036,859	53,405	258,038	3,578	16,391	263,491	1,311,288
Yellowtail.....	10,270	64,890	18,783	112,000			29,053	171,460
Clams:					1,042	11,400	1,042	11,400
Not cooked.....	49,337	211,008	9,542	39,699			58,879	250,707
Clam juice.....	7,505	4,066					7,505	4,066
Not cooked.....	7,270	1,050	225	810			7,495	1,860
Oysters, not cooked.....	4,944	2,427					4,944	2,427
Miscellaneous.....	49,103	120,513	252	3,169	29,400	75,804	78,503	196,317
Total.....		6,765,023		2,700,503	65,357	372,366	965,639	375,535
								11,675,331

<sup>a</sup> Includes 640 pounds of cockles, valued at \$164.<sup>b</sup> Value estimated.<sup>c</sup> The statistics for 1908 in this table are from data published by the Bureau of the Census.<sup>d</sup> All products except clams and clam juice, which have no uniform weight, represent 48 pounds to the case.<sup>e</sup> Includes 653 cases smoked before canning.<sup>f</sup> Includes 650 cases smoked before canning.<sup>g</sup> Includes shad, 9,906 cases, valued at \$29,575; shad roe, 6,563 cases, valued at \$80,362; and 49,170 cases sardines, abalone, crabs, rockfish, and mussels, valued at \$265,593.

## VESSEL FISHERIES AT SEATTLE, WASH.

Statistics of the vessel fisheries at Seattle, Wash., have been collected by the local agent and published as monthly and annual bulletins giving the quantity and value of fishery products landed by American fishing vessels at that port.

In 1916 there were landed at Seattle by American fishing vessels 517 trips aggregating 17,411,435 pounds of fish, having a value to the fishermen of \$1,361,233. These fish were taken from the fishing grounds along the coast from off the Columbia River northward to Portlock Bank, Alaska. The products included 15,317,992 pounds of halibut, valued at \$1,306,645; 2,039,200 pounds of sablefish, or black cod, valued at \$53,438; and 54,243 pounds of other species, valued at \$1,150.

The fishery products taken in Puget Sound and landed at Seattle by collecting vessels amounted to 10,137,387 pounds, valued at \$471,259. These products included 8,141,682 pounds of salmon, valued at \$427,812; 1,425,989 pounds of herring, valued at \$9,028; 149,214 pounds of steelhead, valued at \$12,405; 61,957 pounds of salmon trout, valued at \$5,201; 41,274 pounds of smelt, valued at \$2,130; 59,487 pounds of flounders, valued at \$1,025; 47,071 pounds of sole, valued at \$1,164; 127,388 pounds of crabs, valued at \$8,890; and a number of other species in smaller quantities. The quantity and value of fishery products landed at Seattle by fishing and collecting vessels in 1916 are given in detail in the following tables:



QUANTITIES AND VALUES OF CERTAIN FRESH FISHERY PRODUCTS LANDED AT SEATTLE, WASH., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1916.

BY FISHING GROUNDS.

[illegible]

BY MONTHS.

[illegible]

## FISHERY PRODUCTS, BY MONTHS, TAKEN IN PUGET SOUND AND LANDED AT SEATTLE, WASH., BY COLLECTING VESSELS DURING 1916.

Species.	January.		February.		March.		April.		May.		June.		July.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Sturgeon.....	34,200	\$171	169,900	\$751	754,600	\$5,737	11,170	1,117	198,780	14,654	561,544	42,116	688,883	41,333
Herring.....	4,000	200							304	\$15	3,236	\$87	1,626	\$81
Salmon:									452,400	2,262	26,576	1,933	28,665	17
Chum or keta.....									16,742					
King or spring.....														
Coho or silver.....														
Sockeye or red.....														
Trout:														
Steelhead.....	16,962	1,557	14,011	1,243	4,311	366	17,400	1,740	34,023	2,730	17,698	1,416	7,675	481
Salmon.....														
Smolt.....	350	10	59	2			6,070	486	18,182	1,548	5,290	529	6,130	613
Perch.....							2,000	100	550	26	2,385	48	3,680	168
Red rockfish.....														
"Lingcod".....														
Tomcod.....			275	3			1,400	35	1,492	19	500	10	450	9
Flounders.....	784	12	512	7	850	17	1,800	45	9,382	164	13,084	199	13,030	261
Sole.....					1,060	32	2,400	72	7,450	186	5,535	137	6,270	187
Other fish.....			614	8							2,075	104	5,200	208
Crabs.....	3,384	338	9,240	462	26,456	2,070	38,390	2,017	25,608	1,746	21,310	1,657		
Shrimp.....									1,800	180	4,500	450		
Total.....	59,680	2,288	194,611	2,476	787,277	8,222	91,123	6,311	767,013	24,826	711,979	52,027	798,851	47,150

Species.	August.		September.		October.		November.		December.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Sturgeon.....	2,104	\$105	5,200	\$312	2,545						13,491	\$702
Herring.....	2,000	20									1,425,989	9,028
Salmon:												
Chum or keta.....	3,000	65									3,000	65
King or spring.....	127,340	5,094	163,200	11,424	2,035,613	61,068	746,000	\$33,570	502,760	\$27,652	3,578,913	139,008
Coho or silver.....	753,142	45,189	428,870	30,020	31,512	1,733	34,450	2,067	6,500	488	2,714,851	178,717
Sockeye or red.....	156,099	8,805	481,490	33,704	905,260	49,789	129,000	7,115	375	23	1,750,207	104,742
Trout:											94,711	5,280
Steelhead.....	7,959	489	6,200	434	1,025	98	4,500	270	16,850	1,601	149,214	12,405
Salmon.....	15,110	907	7,840	784	1,105	111	2,230	223			61,957	5,201
Smelt.....	8,240	347	13,950	837	8,755	525	3,000	180			41,274	2,130
Perch.....	1,959	59	1,337	137	1,745	70			5,000	150	16,249	887
Red rockfish.....	4,470	224	8,605	485	1,480	74	1,575	78	2,000	100	19,350	957
"Lingcod".....	835	18	1,450	29					10,000	150	15,002	238

Sablefish (black cod)	8,030	80	4,150	83	3,965	79	2,700	54	800	20	800	20	800	35
Tomcod	7,340	147	5,280	106	1,600	32	5,056	151	1,200	24	59,487	24	1,400	35
Flounders	2,844	114							5,080	114	47,071		59,487	1,025
Sole											10,733		47,071	1,164
Other fish											a 127,388		10,733	1,434
Crabs											6,300		a 127,388	8,890
Shrimp													6,300	8,890
Total	1,122,707	61,885	1,129,665	78,355	2,995,205	113,681	928,511	43,708	550,765	30,330	10,137,337		10,137,337	471,259

a 5,923 dozen.

## PRESERVATION AND UTILIZATION OF FISHERY PRODUCTS.

One of the most important services the Bureau can render is to send trained experts to the fishing centers to instruct those desirous of preserving fish by methods new to them, to ascertain by experiment the adaptability of various fishery products to untried methods of preservation of these products, to increase the utilization of waste fish and fish waste, to encourage the adoption of methods which will improve the character of the pack and discourage the use of methods which produce an unsatisfactory pack, to study and attempt to solve obstructive difficulties with which the fishermen are contending, to furnish advice relative to equipment needed and information as to where it may be obtained; in fact, to serve as efficiency experts to the fishery interests.

Although handicapped by lack of adequate provision for work of this character and inability to employ men with the desired basic training because of lack of funds, it has rendered important service to cannery men and others connected with the fisheries in the Middle Atlantic and New England States. There is a pressing demand for work of similar character in the South Atlantic and Gulf States, in the Pacific Coast States, and in the Great Lakes and Mississippi Valley region.

The diversion of some of the menhaden vessels to Government use, thereby diminishing the size of the fleet engaged in catching menhaden for fertilizer; the diversion of large amounts of tankage from the packing houses for hog feed, thereby reducing the sources of supply of ammoniates; the general scarcity of fertilizing materials; and the costliness of feed for poultry and stock, afford a very unusual opportunity for increasing the utilization of fish offal into oil, fertilizer, and fish meal. The amount of unutilized offal is very great. The Bureau has urged the fishermen to install conversion machinery and use this waste, in order to alleviate the shortages of oil, scrap, and meal, and has furnished information relative to machinery needed, etc.

Experiments have been made in the preservation of drum, sea robin, sharks, whiting, menhaden, river herring, bowfin, the milt roe of fishes, and various other neglected or little utilized products by untried methods of preservation, to ascertain the methods best adapted to the preservation of those products for market.

The methods of smoking and cooking smoked fresh-water fishes of various species have been described in circulars prepared and published for wide distribution. Active campaigns of demonstration and instruction were begun before the close of the fiscal year, with the promise of immediate practical results in the increased utilization of the "coarse" fishes.

## CURING ALEWIVES IN THE CHESAPEAKE BASIN.

Coincident with the decreased run of alewives, or river herring, in Chesapeake Bay and tributaries, the value of the fish has increased markedly. The methods of preserving the catch are, however, very wasteful. This is due in part to uneconomical methods of cutting the fish, to the custom of selling the fish by count instead of by weight, to the failure to fully utilize the roe, to lack of knowledge of

proper methods for canning the fish, and to failure to utilize the milt roe for food and more of the fish offal for fertilizer. At present the fish are marketed fresh, smoked, salted, and canned. Some of the roe is canned. The pickled fish are usually prepared in one of three ways, known as "cut" fish, "gross," and "selected roes."

The Bureau has recently been making a study of the industry in this region for the purpose of securing closer cooperation among the fishery interests so as to improve conditions, to give new methods of preserving the various products a trial, and to develop uses and markets for neglected products. By way of experiment, some of the fish were cured after the Scotch method and some of the milt roe was canned. From an analysis of the latter and tests as to the methods of preparation for the table, it appears that this will make a good food product.

The following method of canning alewives has proved quite satisfactory. The fish are cut, washed, and placed in the salting vats in the same manner as if intended for salt curing. After 12 to 14 hours they are removed from the vats and washed in an abundance of luke-warm fresh water. During the washing, they are trimmed, the balance of the fins and scales being removed. They are then cut to can size and placed in the cans, after which they are processed for 55 minutes at 244° F. for No. 1 cans and 60 minutes for No. 2 cans.

Herring roe intended for canning is collected in buckets as the fish are cut and washed in fresh water in special trays, blood and adhering particles of entrails being removed. The roe is then put in the cans. As it swells considerably in processing, the cans must not be entirely filled. If of the sanitary type, the cans are filled to within about three-fourths of an inch of the top with roe and then filled to the edge with cold salt brine, about 1 pound of salt to 8 or 10 gallons of water being used to make the brine. The brine is added solely for seasoning. The cans are immediately capped and placed in the processing baskets. If solder-top cans are used, the filled cans are placed in the exhaust box. Upon removal from the exhaust, the necessary air space is provided for by pressing the roe down with a plunger. Material clinging to the groove where the solder is to be applied is removed with a brush and the cans are capped and tipped. The canned roe is processed in a closed kettle for 45 to 55 minutes at a temperature of 240 to 245° F. The milt roe may be canned in the same manner as the roe except that the cans can be more completely filled, as this product does not swell in processing. As the quantity of brine used in this case will be somewhat less, it should be made correspondingly stronger.

#### EXPLOITATION OF NEGLECTED AQUATIC FOODS.

The Bureau has continued its active campaign in behalf of neglected products, more particularly those suitable for food, and has scored further successes in this important field.

The history of the establishment of the tilefish fishery was referred to at length in the last annual report, in which it was shown that to the end of the fiscal year 1916, when the fishery had been in existence only 8 months, there had been caught over 4,388,500 pounds of tilefish, for which the fishermen received more than \$210,000. By

the end of the first 12 months, the known catch was upward of 10,250,000 pounds, valued at more than \$400,000. During the fiscal year 1917, the landings aggregated 11,641,500 pounds, and the receipts of the fishermen exceeded \$477,730. A feature of the fishery in that year was the increased receipts at Boston and the diminished receipts at New York, although New York, at the end of the year, continued to be the chief center of the business.

The campaign to make an asset out of one of the most destructive and neglected fishes of the Atlantic coast, namely, the spiny dogfish, has progressed rapidly and well, notwithstanding local opposition and a counter campaign of misrepresentation and ridicule among a limited number of people who had become committed to another and impracticable way of combatting the dogfish plague.

Among the first steps taken by the Bureau was to suggest a change in the name of the fish for trade purposes. The species has been generally known as dogfish, a name which is objectionable because of the prejudice against it and is not distinctive because it is shared by various other little-regarded marine and fresh-water fishes. People in all parts of the country will eat catfish but are opposed to dogfish. The name adopted was grayfish, which is descriptive, not preoccupied, and altogether unobjectionable.

Although the authority and the funds for carrying on this work were not granted by Congress until the latter part of June, 1916, midsummer found canners in Maine and Massachusetts making arrangements to pack grayfish, and packing actually began in August under an arrangement made with the Bureau by which the fish was to be prepared in a stipulated manner and sold at a price not to exceed a certain low figure, in return for which the label was permitted to state that the fish was packed in accordance with the recommendation of the Bureau of Fisheries. Another early development was the selling of a limited quantity of fresh fish in the New York market, with the indication that demand would increase.

The destructiveness of the grayfish and the extent to which it has interfered with established fisheries have caused the fishermen to look upon it with such aversion that it was only by the exercise of much persuasion that they could be induced to catch the fish or even to bring ashore those caught incidentally with apparatus set for other fishes. An early feature of the campaign was the complete change in the fishermen's attitude after they had become fully informed as to the Bureau's plans; and the autumn of 1916 witnessed the extraordinary sight of New England fishermen going out especially for grayfish and selling their catch at remunerative prices for food.

Although the canneries took all the grayfish they could obtain, when the fish withdrew from New England waters for the winter the season's pack was not as large as desired by the canners or contemplated by the Bureau in its publicity campaign, and in the marketing of the pack it soon became evident that the demand far surpassed the supply. The canned fish met with very ready sale, and long before the winter was over the entire pack was disposed of and orders continued to arrive from all parts of the country. The goods proved to be not only one of the best canned products on the market but also one of the most economical to the consumer, who could buy at retail for 10 cents a can containing 14 ounces net weight of fish.

The limited quantity of grayfish which the canners found it possible to pack on the Atlantic coast having become exhausted, arrangements were made in December for the inauguration of grayfish canning on Puget Sound, where the fish are found in numbers in winter as well as in summer. The salmon canneries of Washington are idle in winter, and the owners showed much interest in the project presented to them of being able to keep their plants open when they had formerly been unproductive. One cannery began operations almost immediately and by March, 1917, this had been joined by two or three others, while four or five others had announced their intention to experiment with the fish with the view of entering the business if the industrial conditions warranted it. The entire prospective pack of the first concern was contracted for, and it was stated that one packer had been obliged to refuse an order of 20,000 cases on account of the scarcity of cans. A number of orders for export were received but were declined by the canners in deference to the Bureau's desire first to satisfy the heavy domestic demand.

In the latter months of the fiscal year the demand for grayfish continued to increase. Although the canned product had been known to the trade and public only since October, in April, 1917, it was known to be handled by dealers in 128 cities and towns in New York and Pennsylvania alone, and by May the fish was on sale by retailers in 30 States and the District of Columbia.

With the return of grayfish to the coastal waters of New England in the spring of 1917, canning was resumed in Massachusetts, and there is every indication that the output for the calendar year will be greatly in excess of 1916 and that the fish will henceforth have a market for fishermen and packers.

The Office of Home Economics of the Department of Agriculture has conducted experiments in feeding canned grayfish to human beings, and has found that 92.8 per cent of the protein is digested as compared with 94.5 per cent in the highest grade of Columbia River salmon, 93.1 per cent in fresh mackerel, and 91.9 per cent in fresh butterfish. Ninety-five per cent of the fats in grayfish were digested as compared with 94.3 per cent in salmon, 95.4 per cent in mackerel, and 89.9 in butterfish.

Early in the fiscal year the Bureau opened negotiations with the fishery interests of Puget Sound regarding a campaign to increase the consumption of the so-called "black cod," a fish of excellent quality and high food value. In anticipation of the creation of a public demand, considerable quantities were placed in the freezers in Seattle and Tacoma during the summer and fall. The fish is not related to the cod family and in the interest of accuracy it was renamed sablefish, and it began to be exploited under that name in January, 1917. It immediately found a ready market and moved from the cold storage plants so rapidly that it was determined to defer a more vigorous propaganda until spring, when it could be caught in larger numbers. In April, display cards and other advertising matter were issued and its excellent qualities were called to the attention of the public through the newspaper and magazine press. As a result, upwards of 2,000,000 pounds of the frozen fish and 1,304,000 pounds in the fresh state were disposed of by the dealers by June 30, and reports at that time indicated that it was being landed in larger quantities by the fishermen of the Pacific Coast States and that a

considerable fishery was developing in Alaska. The sablefish is abundant along the entire Pacific coast north of San Francisco, and it is believed that it is destined to afford a very important food supply to the country.

A similar undertaking in respect to the burbot was inaugurated about the time of the opening of the Great Lakes fisheries in April. The burbot, which is a fresh-water member of the cod family, is an abundant fish of the large bodies of water of the northern part of the United States, and not only has been neglected as a food resource but on account of its predaceous habits is destructive of other food fishes. Effective cooperation was established with a number of the principal wholesale fish dealers at Great Lakes ports, and about 500,000 pounds of burbot were marketed by them between April 1 and June 30. This fish is generally sold skinned, eviscerated, and headless; and as the price is low it affords an economical food supply of good quality.

Experiments in smoking various species of fresh-water fish, begun at the Fairport station some two years ago, have yielded interesting results. The bowfin or grindle, which is usually regarded as practically worthless, has been found to yield a very superior product when properly smoked. Everyone who has sampled the product has testified to the excellent texture and flavor of the meat and some pronounce it the best of smoked fish. The bowfin is generally known through the Mississippi Basin as dogfish or grindle. It is an abundant form in the Great Lakes and in sluggish waters from Minnesota and New York to Florida and Texas. The proper utilization of this species will not only add another commercial product to the market but will tend to reduce the relative abundance of a species which is most predatory upon the other fishes that are more highly valued in the fresh state.

#### EXPLOITATION OF ALASKAN FISHERY RESOURCES.

An innovation in the Alaska field and a contribution to food preparedness has been the comprehensive campaign inaugurated by the Bureau to encourage the utilization of fishery products heretofore more or less neglected. At the same time attention has been directed particularly toward the packing of herring by the Scotch method, which heretofore has not been attempted in Alaska, all herring for food purposes having been preserved by the more simple Norwegian method. The Bureau secured the services of a recognized authority in the curing of Scotch herring and sent him to Alaska in the spring of 1917. Three special assistants, graduates of the fishery school of the University of Washington, were employed by the Bureau to accompany the expert and acquire all information possible in regard to the improved methods. Several of the regular employees of the Alaska service also were detailed to learn these new methods, so as to be able to instruct the fishermen.

Very gratifying results have followed this campaign, as the fishery interests have shown a marked interest and a desire to give practical effect to the Bureau's work. The herring fishery of Alaska has not been developed to anything like the extent of its possibilities, and as a result of the interest manifested by the trade it is probable that the product in 1917 will be more than double that of any previous season.



It is believed that at least 25,000 barrels of Scotch-cured herring will have been prepared in Alaska in 1917, this in addition to a substantial pack of herring prepared in the Norwegian style. The largest pack of Norwegian herring heretofore made in Alaska in any one year was approximately 18,000 barrels.

Efforts are being made by the Bureau's agents to develop the use of other species of fishes, particularly the sablefish and atkafish. The latter, improperly called atka mackerel, is excellent when salted like mackerel. It is abundant in parts of Alaska but is entirely unknown in the markets.

#### MARKETING CARP ALIVE.

The carp is generally marketed fresh, smoked, or alive, the principal markets being in the large cities in the East which have a foreign population. As a result of various inquiries regarding the feasibility of shipping carp alive from Pacific Coast States to New York City and other eastern points, the Bureau conducted a brief investigation of the methods employed in handling this product. Normally two car-loads of carp are shipped each week into New York City, principally from Port Clinton or Sandusky, Ohio, occasionally from other points in the Great Lakes and upper Mississippi Valley region.

The fish are transferred from the nets to large live cars and towed to the shipping point or to retaining ponds to be held for shipment later. Those held in ponds are fed regularly on grain to fatten and harden them. At the point of shipment, the carp are transferred to tanks in the cars, which are usually old baggage cars. Each car is equipped with 8 to 10 galvanized-iron tanks arranged along the sides with a passageway about 2 feet wide running through the center. The space under the passageway serves to hold ice in which the fish which die in transit are iced.

The tanks are about 3 feet wide, 3 feet deep, and 8 to 10 feet long, heavily reinforced with strips of angle iron. A strip of metal about 8 inches wide extends inward from the upper edge to keep the water from sloshing out and the fish from jumping out. When the car is in motion the balance of the opening is covered with a solid cover. Running lengthwise along the bottom of the tanks are one-half-inch galvanized-iron pipes, perforated at intervals of about 4 inches along the upper side with very small, uniform-sized openings for aeration. A wire grating covers these pipes. When the car is stationary or moving slowly, air is passed through the pipes by a pump operated by a set of storage batteries, which are recharged while the car is in motion by a belt attached to the car axle. When the car is moving more rapidly, a floor pump, connected directly with the axle of the car furnishes the necessary power. In warm weather the air, before entering the tanks, is cooled by passing through a set of coils surrounded with ice. In transit the constant attention of a skilled attendant is required to care for machinery and fish.

The amount of fish which can be transported with reasonable safety depends upon prevailing conditions of temperature and distance, varying from about 8,000 to 20,000 pounds.

At the terminus, the fish are transferred to tanks on automobile trucks and delivered to the retailers, who have tanks with running

water for keeping the fish alive. In the live-carp trade, fish weighing from 2 to 3 pounds are preferred. In the fresh (dead) carp trade, fish weighing from 3 to 5 pounds, and for smoking still larger fish, are preferred.

#### DEVELOPMENT OF AQUATIC SOURCES OF LEATHER.

There is a growing scarcity of mammal hides used in the manufacture of leather. The fishermen have no established market for fishskins. A small demand for certain fishskins for special purposes exists, but difficulty is experienced by those using these products to get in touch with sources of supply. These facts have led the Bureau to investigate the possibilities of making satisfactory leathers from fishskins and establishing a market for these products. The tasks confronting it are to induce tanners to develop processes suitable for converting fishskins into high-grade leathers and thus create a market for the raw hides, to instruct the fishermen in preparing the hides properly for the tanner, to encourage them to save and market the skins, to ascertain to what uses the leathers are best suited, and to determine the extent and sources of demand for fishskins for other purposes.

The Bureau has distributed several hundred skins of sharks and other fishes, including cod, hake, grouper, gar, ray, catfish, and wolf-fish, among tanners for experimentation. A number of tanners are interested in the project and are developing processes capable of producing some very creditable leathers. The larger samples have been submitted to the Bureau of Standards for testing as to tensile strength. The average tensile strength of one of the shark skins examined was 3,479 pounds per square inch. Such data are being used for comparison with other leathers. Of the skins tanned, those of the various sharks are the most promising.

Present methods of skinning sharks are slow and tedious. Special instruments have been made and are being tried out for the purpose of overcoming these difficulties. Instructions have been furnished fishermen regarding the curing and packing of skins for shipment, and the names of tanners desirous of obtaining raw materials have been supplied.

Formerly large quantities of shark skins, cleaned but not tanned, were used for polishing wood, ivory, and the like. Because of the roughness, hardness, and durability of the outer surface, they were especially serviceable for this purpose. Although sandpaper and emery preparations have largely replaced such materials, there is still a small demand among cabinetmakers for certain of these hides. It remains to ascertain what hides are best suited to the needs of the various trades and arrange for supplies of these materials. In the past, shark-skin leathers have been used to a very limited extent for various ornamental and novelty purposes. The results of experiments recently made in the tanning of these skins indicate that they can be used on a commercial basis for bag, belt, and similar purposes, and this information is being brought to the attention of manufacturers of such articles. The Bureau is also endeavoring to ascertain whether an industry can be built up which will utilize the skins of smaller fishes, such as cod, hake, grouper, burbot, rays, catfish, etc., on a commercial basis. These and other problems have received

attention, and those obstructive to the development of the industry are being solved.

Congress passed an act, approved June 12, 1917, authorizing the Bureau to conduct a careful investigation in this field. This act carried an appropriation of \$10,000 to enable the Bureau of Fisheries, in cooperation with the Bureau of Standards, to develop new aquatic sources of supply of leather.

## PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

### GENERAL REVIEW OF OPERATIONS.

Conspicuous success and progress have characterized the year's work in fish culture. While the output of several of the important species was less than the average in recent years, the aggregate output was larger than in any previous year, the increase over 1916 being somewhat more than 6 per cent. Among the fishes produced in about the same numbers as in 1916 were shad, whitefish, silver salmon, chum salmon, rainbow trout, and brook trout. Species whose output was smaller were chinook salmon, sockeye salmon, grayling, smelt, black bass, pike perch, yellow perch, white perch, cod, and lobster. Increased production was secured in the case of catfish, buffalofish, silver salmon, humpback salmon, steelhead salmon, Atlantic salmon, landlocked salmon, lake trout, striped bass, pollock, and winter flounder. The somewhat detailed discussion which follows shows the reasons for the gains and losses in the different fields. The total output was 5,158,963,295, compared with 4,847,262,565 in 1916.

Following is a summarized table showing the number of fish eggs and fish distributed by the Bureau in the past year. Most of the eggs herein noted were transferred to various State hatcheries.

## SUMMARY, BY SPECIES, OF THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1917.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish			4,251,289	4,251,289
Carp		112,000	605,407	717,407
Buffalofish		6,754,000	207,898	6,961,898
Shad		77,946,000		77,946,000
River herring			177,000	177,000
Whitefish	52,602,500	331,610,000		384,212,500
Lake herring (cisco)		82,550,000		82,550,000
Blueback salmon		75,038,525	5,793,953	82,832,478
Chinook salmon	2,000,000	16,404,404	27,065,581	50,061,185
Chum salmon	7,191,200	14,403,300	7,014,580	21,417,880
Humpback salmon		27,406,204	7,449,030	34,855,234
Silver salmon		4,040,700	4,662,960	9,066,660
Steelhead salmon	3,237,600	2,040,710	2,061,709	7,340,019
Atlantic salmon		3,028,850	887	3,029,737
Landlocked salmon	531,000	798,689	177,635	1,507,324
Rainbow trout	1,454,200	250,200	2,574,942	4,279,342
Blackspotted trout	1,630,000	2,051,400	2,683,900	6,365,300
Loch Leven trout			25,860	25,860
Lake trout	35,332,000	33,395,155	3,699,158	72,426,313
Brook trout	935,600	5,972,495	7,868,932	14,777,027
Sunapee Lake trout		8,000		8,000
Grayling	125,000	1,078,000		1,203,000
Smelt		28,000,000		28,000,000
Pike and pickerel			103,643	103,643
Freshwater drum			29,804	29,804
Crappies			1,565,072	1,565,072
Largemouth black bass		320,050	961,912	1,281,962
Smallmouth black bass		237,600	149,837	387,437
Rock bass			91,742	91,742
Warmouth bass			2,400	2,400
Sunfish			2,670,513	2,670,513
Pike perch	212,900,000	174,097,500	15,874	387,013,374
Yellow perch		175,421,000	163,839	175,584,839
White perch		32,625,000		32,625,000
White bass			15,298	15,298
Striped bass		16,137,000		16,137,000
Mackerel		2,341,000		2,341,000
Butterfish		920,000		920,000
Cod	1,000,000	236,786,000	2,648	237,788,648
Pollock		1,474,096,000		1,474,096,000
Haddock		6,720,000		6,720,000
Flounder		1,814,696,000		1,814,696,000
Miscellaneous fishes			16,708	16,708
Lobster		110,260,000	5,400	110,265,400
Total	318,939,100	4,757,908,782	82,115,411	5,158,963,293

The foregoing output may be conveniently classified on the following geographic basis, which agrees quite closely with the general character of the operations of the hatcheries:

Marine species of the Atlantic coast	3,646,827,048
Migratory species of the Atlantic coast	333,322,576
Fishes of the Great Lakes	926,201,687
Migratory fishes of the Pacific coast	206,173,456
Fishes of the interior waters	46,438,526
Total	5,158,963,293

It is possible to record a further reduction in the unit cost of fish-cultural operations. Taking into consideration all expenditures chargeable to fish culture and fish distribution, together with the salaries of all employees in the fish-cultural service, the cost of fish produced and planted in 1917 was \$114.46 per million, as against \$117.86 in 1916, \$131.65 in 1915, \$146.36 in 1910, and \$239 in 1905. This record is noteworthy in view of the increased cost of all supplies, materials, and temporary labor, and indicates increased efficiency and economy.

## HATCHERIES OPERATED.

During the year the Bureau operated 55 regularly established hatcheries, 19 subhatcheries, and 74 egg-collecting stations. The stations in alphabetical order, with the subsidiary stations thereunder, the period of operations, and the species handled, are shown in the following table:

## FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1917.

Designation.	Period of operation.	Species handled.
Afognak, Alaska.....	Entire year.....	Blueback and humpback salmons.
Seal Harbor, Alaska.....	June-October.....	Blueback salmon.
Uganak, Alaska.....	do.....	Do.
Baird, Cal.....	Entire year.....	Brook and rainbow trouts, chinook salmon.
Battle Creek, Cal.....	December-April.....	Chinook salmon.
Hornbrook, Cal.....	January-May.....	Chinook and silver salmons, rainbow trout.
Mill Creek, Cal.....	December-April.....	Chinook salmon.
Baker Lake, Wash.....	Entire year.....	Blueback, chinook, silver, and steelhead salmons.
Birdsview, Wash.....	do.....	Blueback, chum, humpback, silver, and steelhead salmon.
Brinnon, Wash.....	do.....	Chum and silver salmons, steelhead salmon.
Barrington, Wash.....	April-June.....	Chum and silver salmons.
Duckabush, Wash.....	October-June.....	Chinook, chum, humpback, silver, and steelhead salmons.
Illabott Creek, Wash.....	do.....	Chinook and chum salmons.
Quilcene, Wash.....	Entire year.....	Chum, humpback, silver and steelhead salmons.
Quinalt, Wash.....	do.....	Blueback, chinook, and silver salmons.
Sultan, Wash.....	do.....	Silver and steelhead salmons.
Boothbay Harbor, Me.....	do.....	Flounder, pollock, lobster.
Portland, Me.....	July-October, May-June.....	Lobster.
Bozeman, Mont.....	Entire year.....	Blackspotted, brook, rainbow, and lake trouts, steelhead salmon, grayling.
Odell Creek, Mont.....	March-May.....	Grayling.
Meadow Creek, Mont.....	do.....	Grayling and rainbow trout.
Yellowstone, Wyo.....	July and June.....	Blackspotted trout.
Clear Creek, Wyo.....	do.....	Do.
Columbine Creek, Wyo.....	do.....	Do.
Cub Creek, Wyo.....	do.....	Do.
Lake Camp, Wyo.....	do.....	Do.
Pelican Creek, Wyo.....	do.....	Do.
Bryans Point, Md.....	March-May.....	Shad and yellow perch.
Cape Vincent, N. Y.....	Entire year.....	Brook, lake, and rainbow trouts, lake herring, landlocked salmon, pike, and yellow perches, whitefish.
Chaumont, N. Y.....	November and December.....	Whitefish.
Galloo Island, N. Y.....	October-November.....	Lake trout.
Grassy Bay, N. Y.....	May.....	Yellow perch.
Henderson Harbor, N. Y.....	November-December.....	Lake herring.
Ogdensburg, N. Y.....	April-May.....	Pike perch.
Pigeon Island, N. Y.....	October-November.....	Lake trout.
Old Forge, N. Y.....	November.....	Whitefish.
Sodus Point, N. Y.....	November-December.....	Lake herring.
Stony Island, N. Y.....	November.....	Lake trout.
Three Mile Bay, N. Y.....	November-December.....	Lake herring and whitefish.
Upper Saranac, N. Y.....	November.....	Whitefish.
Central Station, Washington, D.C.....	Entire year.....	Shad, pike, and yellow perches.
Clackamas, Ore.....	do.....	Brook and rainbow trouts, steelhead, chinook, and silver salmons.
Applegate, Ore.....	April-June.....	Chinook, silver, and steelhead salmons.
Big White Salmon, Wash.....	December-March.....	Chinook salmon.
Snake River, Ore.....	October.....	Do.
Little White Salmon, Wash.....	July-May.....	Chinook and chum salmons.
Rogue River, Ore.....	Entire year.....	Blackspotted trout, chinook, steelhead, and silver salmons.
Upper Clackamas, Ore.....	do.....	Chinook, steelhead, and silver salmons.
Willamette River, Ore.....	July and June.....	Shad.
Cold Springs, Ga.....	Entire year.....	Bass, catfish, sunfish.
Milltown, Ga.....	May.....	Bass.
Craig Brook, Me.....	Entire year.....	Atlantic, humpback, and landlocked salmons, brook trout.
Duluth, Minn.....	do.....	Brook and lake trouts, pike perch, whitefish, steelhead salmon.
Grand Marais, Minn.....	October-December.....	Lake trout, whitefish.
Susie Island, Minn.....	November.....	Lake trout.

## FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1917—Continued.

Designation.	Period of operation.	Species handled.
Edenton, N. C.....	Entire year.....	Black bass, shad, sunfish, white perch. .
Weldon, N. C.....	April-May.....	Striped bass.
Erwin, Tenn.....	Entire year.....	Brook and rainbow trout, black bass, carp, sunfish, rock bass.
Fairport, Iowa.....	.....do.....	Black bass, buffalofish, carp, catfish, crappie, drum, pickerel, pike, perch.
Black River, Ark.....	October-December.....	Black bass, buffalofish, carp, catfish, crappie, pike perch, sunfish, suckers.
Cumberland River, Ky.....	November-December.....	Black bass, crappie, sunfish.
Lake Cooper, Ill.....	August-December.....	Black bass, buffalofish, carp, catfish, crappie, pickerel, sunfish, pike and yellow perches.
Lake Pepin, Minn.....	September-November.....	Black bass, buffalofish, carp, catfish, crappie, pickerel, pike perch, sunfish, yellow perch.
Gloucester, Mass.....	Entire year.....	Butterfish, cod, flounder, haddock, lobster, mackerel, pollock.
Green Lake, Me.....	.....do.....	Brook trout, steelhead, landlocked, and humpback salmons, smelt.
Grand Lake Stream, Me.....	September-June.....	Landlocked salmon.
Homer, Minn.....	Entire year.....	Black bass, buffalofish, catfish, carp, crappie, drum, pike, rock bass, sunfish, yellow and pike perches, brook and rainbow trouts.
La Crosse, Wis.....	.....do.....	Black bass, buffalofish, carp, catfish, brook trout, crappie, drum, pike, pike perch, rock bass, sunfish, yellow perch.
Leadville, Colo.....	.....do.....	Blackspotted, brook, rainbow, and lake trouts, grayling.
Antero Lake, Colo.....	April-May.....	Rainbow trout.
Crystal Lake, Colo.....	November.....	Brook trout.
Englebrecht Lake, Colo.....	October-November.....	Do.
Hoselkuss Lake, Colo.....	.....do.....	Do.
Musgrove Lake, Colo.....	.....do.....	Do.
Northfield Lake, Colo.....	.....do.....	Do.
Smith Ponds, Colo.....	.....do.....	Do.
Turquoise Lake, Colo.....	.....do.....	Do.
Uneva Lake, Colo.....	.....do.....	Do.
Woodland Park Lake, Colo.....	.....do.....	Do.
Seven Lakes, Colo.....	June.....	Blackspotted trout.
Louisville, Ky.....	Entire year.....	Black bass, crappie, pike perch, rock bass, sunfish, chinook salmon, rainbow trout.
Mammoth Spring, Ark.....	.....do.....	Black bass, catfish, rock bass, sunfish.
Friar Point, Miss.....	July-December.....	Black bass, buffalofish, carp, catfish, crappie, rock bass, sunfish.
Manchester, Iowa.....	Entire year.....	Brook and rainbow trouts, rock bass, smallmouth bass.
Bellevue, Iowa.....	August-December.....	Black bass, buffalofish, carp, catfish, crappie, drum, pike, sunfish, warmouth bass, white bass, yellow perch.
North McGregor, Iowa.....	.....do.....	Black bass, buffalofish, carp, catfish, crappie, pike, rock bass, sunfish, yellow perch.
Galena, Ill.....	November.....	Black bass, buffalofish, carp, drum, pike, river herring, sunfish, warmouth bass, yellow perch.
Nashua, N. H.....	Entire year.....	Brook, lake, and rainbow trouts, smallmouth bass.
Neosho, Mo.....	.....do.....	Black bass, crappie, rainbow trout, rock bass, sunfish, yellow perch.
Northville, Mich.....	.....do.....	Brook, lake, and rainbow trouts, smallmouth bass.
Alpena, Mich.....	April-May.....	Lake trout, whitefish.
Bay City, Mich.....	April.....	Pike perch.
Bay Port, Mich.....	November.....	Whitefish.
Brevort, Mich.....	.....do.....	Do.
Belle Isle, Mich.....	October-November.....	Do.
Charity Island, Mich.....	.....do.....	Do.
Charlevoix, Mich.....	April-May, November.....	Lake trout, whitefish.
Cheboygan, Mich.....	October-November.....	Lake trout.
Detour, Mich.....	.....do.....	Do.
Detroit, Mich.....	April-May, December.....	Pike perch, whitefish.
Fairport, Mich.....	October-November.....	Lake trout.
Frankfort, Mich.....	.....do.....	Do.
Grand Haven, Mich.....	.....do.....	Do.
Isle Royale, Mich.....	.....do.....	Lake trout, whitefish.
Keystone, Mich.....	.....do.....	Lake trout.
Leland, Mich.....	.....do.....	Lake trout, whitefish.
Manistique, Mich.....	.....do.....	Lake trout.
Marquette, Mich.....	.....do.....	Do.
Monroe, Mich.....	April-May.....	Pike perch.

## FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1917—Continued.

Designation.	Period of operation.	Species handled.
Northville, Mich.—Continued.		
Munising, Mich. ....	October-November. ....	Lake trout.
Munoscong, Mich. ....	April. ....	Pike perch.
Naubinway, Mich. ....	October-November. ....	Whitefish.
Northport, Mich. ....	do. ....	Lake trout, whitefish.
Ontonagon, Mich. ....	do. ....	Lake trout.
St. Ignace, Mich. ....	do. ....	Lake trout, whitefish.
St. James, Mich. ....	do. ....	Lake trout.
St. Joseph, Mich. ....	do. ....	Do.
South Manitou, Mich. ....	December. ....	Whitefish.
Port Lookout, Mich. ....	do. ....	Do.
Orangeburg, S. C. ....	Entire year. ....	Black bass, sunfish.
Branchville, S. C. ....	March-April. ....	Shad.
Jacksonboro, S. C. ....	do. ....	Do.
Put in Bay, Ohio. ....	Entire year. ....	Lake trout, whitefish, pike, perch.
Middle Bass, Ohio. ....	April, November - December. ....	Pike perch, whitefish.
North Bass, Ohio. ....	do. ....	Do.
Port Clinton, Ohio. ....	do. ....	Do.
Toledo, Ohio. ....	do. ....	Do.
Quincy, Ill. ....	Entire year. ....	Black bass, buffalofish, catfish, crappie, pike perch, rock bass, sunfish, yellow bass, yellow perch.
St. Johnsbury, Vt. ....	do. ....	Brook, lake, rainbow, and sunapee trouts, landlocked and steelhead salmon, yellow perch.
Darling Pond, Vt. ....	July-December. ....	Brook trout.
Holden, Vt. ....	Entire year. ....	Brook, lake, and rainbow trouts, steelhead and landlocked salmon.
Lake Mitchell, Vt. ....	September-December. ....	Brook trout.
Swanton, Vt. ....	April-May. ....	Pike and yellow perches.
Berkshire, Mass. ....	Entire year. ....	Brook trout.
San Marcos, Tex. ....	do. ....	Black bass, crappie, rock bass, sunfish.
Saratoga, Wyo. ....	do. ....	Blackspotted, brook, and rainbow trouts, steelhead salmon.
Spearfish, S. Dak. ....	do. ....	Brook, blackspotted, lake, rainbow, and Loch Leven trouts.
Tupelo, Miss. ....	do. ....	Black bass, catfish, crappie, sunfish.
White Sulphur Springs, W. Va. ....	do. ....	Brook and rainbow trouts, black bass, sunfish.
Woods Hole, Mass. ....	do. ....	Cod, flounder, mackerel.
Menemsha, Mass. ....	January-April. ....	Flounder.
Waquoit, Mass. ....	do. ....	Do.
Wickford, R. I. ....	do. ....	Do.
Wytheville, Va. ....	Entire year. ....	Black bass, brook and rainbow trouts, rock bass, sunfish.
Yes Bay, Alaska. ....	do. ....	Blueback salmon.
Smeaton Bay, Alaska. ....	August-September. ....	Do.

Early in the fiscal year an additional hatchery was added to the number already in operation, through the acceptance of a donation by Mrs. Mary A. Scully of a trout-hatching plant which had been constructed and successfully operated as a private venture for some years by her husband, the late John S. Scully, of Massachusetts. This property consists of about 135 acres of land in the heart of the Berkshire Hills, some 7 miles from Great Barrington, Mass., with the ponds and buildings required for a complete trout hatchery. A joint resolution of Congress, authorizing the Secretary of Commerce to accept the gift on behalf of the Government was signed by the President on July 28, 1916, and shortly thereafter the Bureau instituted active trout operations with the stock of fish included as a part of the donation.

## DISTRIBUTION OF THE HATCHERY OUTPUT.

The output of the hatcheries, planted under favorable conditions and in well-considered places, reached every State and Alaska. The commercial fishes were distributed for the most part in local waters,

on the initiative of the Bureau and under the immediate direction of the various station superintendents. The fishes adapted for the minor interior waters were largely planted on applications from States, clubs, associations, and individuals bearing the indorsement of Senators or Representatives.

In the course of the year the fish-distributing cars traveled a total of 138,717 miles, the paid transportation amounting to 122,778 miles. Although the output of fish was larger than ever before, a material reduction in distribution expenses by messengers was effected, through the systematic planning of the work with the view of supplying all species without covering the same territory twice. By this means the messenger travel of 645,721 miles in 1916 was reduced to 554,597 miles in 1917. The average cost per mile for movement of the Bureau's cars, based on data compiled for the fiscal year 1916, was \$0.144, including fares of the car crews.

A new fish transportation car, for which Congress had provided an appropriation of \$20,000, was completed and put in commission shortly after July 1, 1916. This car is of steel construction throughout except for the doors and windows, and is equipped for carrying 140 cans of fish. Its use has greatly facilitated the distribution work, as it carries a load almost 50 per cent larger than the old cars.

Small shipments of eggs have been made to foreign countries, in response to official requests. Thus, there were forwarded to Canada 96,000 rainbow-trout eggs and to Japan 100,000 brook-trout eggs and 101,000 rainbow-trout eggs. To the Canal Zone there were sent 2,750 fingerling, black bass, catfish, rock bass, and sunfish, at the request of the canal administration.

A detailed statement of the distribution and planting of fish is published separately as a part of this report, and is available for gratuitous distribution. This statement shows by States and localities the number and age of fish of each species distributed during the year.

#### PROPAGATION OF THE PACIFIC SALMONS.

The run of both red and humpback salmon in the vicinity of the Afognak station was the largest that has occurred in that region since the year of the eruption of Mount Katmai in 1912. In connection with the run of the former species, it is noteworthy that Litnik Lake was the only point in the ash belt where any number of redfish were noticeable, and nearly all the other lakes which they frequented before the eruption were barren. Whether this run, consisting of individuals of an inferior size, was affected by remote influences or was in part or altogether the result of the hatchery plantings is conjectural.

Collections of red-salmon eggs extending from July 26 to October 18 amounted to 22,424,000, of which 4,678,000 were taken at Seal Bay and 692,000 at Uganak Bay. To these acquisitions was added a gift of 1,016,000 eyed eggs from the Karluk hatchery of the Alaska Packers Association. Some of the later eggs were more than seven months in process of hatching, due to the fact that the water temperature remained around 33° F. until after the middle of April, following a very severe winter. Fry began taking food late in April, and 8,871,000 were on hand at the end of the fiscal year after 10,296,000 had been liberated. Freshened salt salmon, a by-product of spawning operations, was fed with satisfactory results. Its prepa-



ration consisted in soaking in running water for 24 hours, removing skin and bones, and grinding. It was next placed in boiling water, which caused the flesh to granulate, and was then reground. When granulated by the boiling-water treatment a greater proportion is eaten, whereas when the raw flesh is reduced to a fine state by the second grinding a large part, in the form of a milky fluid, is lost when put into the water. The fry are fed from six to eight weeks, and released only when it becomes necessary to provide feeding space for more recent hatchings.

At Litnik Lake 25,310,000 humpback-salmon eggs were collected between August 11 and September 11. At Seal Bay 3,010,000 of this species were obtained and more were in sight, but collecting had to be discontinued in order to reserve space for redfish eggs. At Uganak Bay when 10,730,000 had been taken all space was filled and collections were necessarily suspended. Late in October all these eggs were transferred from the field stations to Afognak hatchery and the auxiliaries were closed. In the course of the season, a transfer of 16,000,000 humpback-salmon eggs was made to Seattle, Wash., half of them being destined to Puget Sound stations and half to stations in Maine. The 19,343,000 humpback fry produced at Afognak were held as long as possible, but owing to lack of room it was necessary to plant them prior to sac absorption. Most of them were released in the river below the lake and were widely scattered so that they might settle in crevices between the rocks covering the river bed.

Although the run of red salmon in the vicinity of Yes Bay station was commercially far below that of the preceding year, a good collection of eggs was made. Although the number secured was not as large as in the previous year, when 72,000,000 were taken, the figures of the average year were surpassed by several millions.

While facilities for rearing were limited, more than 800,000 fingerlings were produced and liberated in the course of the season and 785,500 were being held at the end of the fiscal year. From 58,000,000 eggs collected, mainly in September, 49,600,000 fry were liberated, and 2,000,000 eyed eggs were supplied to the Oregon State hatchery at Bonneville. The salt-solution process was employed for the removal of dead eggs.

The combined output of fingerling salmon from the Washington stations was above 37,000,000, while upward of 3,000,000 additional, in process of rearing, were carried over into the new fiscal year. Steelhead fingerlings released numbered nearly 4,000,000. Egg collections at these stations were generally successful, though diminished because of the off year for humpback salmon. A feature at Birdsvew station was the taking of 38,000 humpback-salmon eggs. This species has heretofore visited these waters only every second year, and this appearance in Grandy Creek can not be regarded otherwise than the result of the Bureau's effort to establish an annual run by the transfer of eggs from Alaska. Conditions were most unfavorable during the humpback run, Grandy Creek being at a low stage, and the water spread out over the wide gravelly bar at the creek's mouth, making it difficult for fish to enter. No eggs were taken at any other Washington station, although fishermen, noting their off-year appearance, made reports from various places which indicated the taking of quite a number. Alaska humpback fry, the product of 4,000,000 eggs, were again introduced in this stream. The same conditions that hampered

the entrance of humpbacks into the creek prevailed during the sockeye run, otherwise larger results would undoubtedly have been recorded. In the spring, several sockeye salmon, from 6 to 10 inches in length, were taken in the creek. Another shipment of 225,000 eggs was sent from Quinault station in order to continue the plantings in Puget Sound.

Low water curtailed the chinook-egg collections in the Puget Sound region, but hatching results were good, the fry taking food more readily and developing more rapidly than any other species. The steelhead run was late, but nearly as many eggs were collected as last year, and over a million were transferred to Maine and other points eastward. The take of silver-salmon eggs was 2,000,000 in excess of last year.

At Baker Lake the sockeye-egg collections numbered 5,445,000, surpassing the previous year by 2,000,000. An unusual occurrence was the fact that about 22 per cent of the eggs could not be fertilized, though the fry resulting from the fertile ones were normal. The silver-salmon eggs were infertile to a somewhat greater extent. A battery of troughs was set up outside the hatchery for the rearing of fry. All fish were fed to some extent prior to releasing them. All chum and silver salmon fry at Darrington station were reared to the feeding stage. There was an increase in the aggregate egg collections of chinook, chum, silver and steelhead salmons at Ilabot Creek station, but at Day Creek a falling off occurred. All eggs at the latter point were transferred to Birdsvie for hatching. At Sultan station a washout reduced the egg collections. All fry at this point were fed prior to release. A slough pond, 150 by 4 feet in area and 1½ feet deep, was constructed, and used with excellent results for holding and feeding young fish.

At Duckabush station there was an unusually small run of chum salmon, and as trouble was experienced from log jams, at least half the run of chum and all the silver salmons escaped capture. At Brinnon station, though conditions were like those at Duckabush, increased collections of silver and chinook salmons eggs were made, despite the fact that unlawful purse-seine fishing was conducted below, for which some of the fishermen were convicted by State authorities. Most of the steelhead run at this station escaped when the rack was washed out in May or when log jams prevented fishing. The work at the Duckabush and Quilcene stations was greatly facilitated by the purchase of two motor trucks during the latter part of the fiscal year.

An interesting item in connection with the work at this field was the result attained from feeding in the so-called slough pond, an arm of the Walcotts Slough, which was screened to exclude enemy fish. All the salmon fry hatched at Brinnon, and the younger specimens of fish forwarded from Duckabush and Quilcene, were placed in this pond and fed regularly. They made a rapid growth and the losses were slight. They were allowed to pass out at will, the meshes of the screen being large enough to permit their escape. The chum salmon left the slough at the end of four or five weeks, although they had in almost every case been fed for about the same length of time in troughs or cement ponds before their transfer to the slough. The chinook and silver salmons remained for a longer period and left the slough in a body.

At Quilcene station the collections of all species except humpback were larger than last year, a noticeable increase being in steelheads, which numbered 420,000 as against 45,000 in the previous year. Good success was attained in hatching, the fry losses were normal, and all young were fed and planted as advanced fry or fingerlings. Two million humpback eggs from Afognak station, Alaska, hatched well, and the young were reared to fingerling size before liberation.

A power machine for grinding fish food was installed at Birdsvie and a motor truck was acquired, and both appliances effected important economies in time and labor. The shore of Grandy Creek was protected by a plank wall for arresting erosion and to prevent the flooding of the station grounds. At Illabot and Day Creeks the battery shelters were inclosed with rough-board siding for the exclusion of snow and wind, and at the former a heating coil was installed, its hot-water discharge entering the hatchery supply flume, with the object of preventing freezing and water stoppage. At Sultan the open end of the hatchery was boarded in, 11 new troughs and fittings were added, and an earth rearing-pond was constructed.

The Quinault, Wash., substation is located on one of the most important blueback-salmon streams in the United States at the present time, but it is unquestionably being heavily overfished. While the close season is always complied with, it consists of only one day each week, and as fishing operations are conducted for a distance of several miles up the river, it is believed the fish entering the streams at the beginning of a closed period do not pass beyond the last traps before fishing is again resumed. The run of four years ago was extremely small and was in part responsible for the diminished numbers entering the past season. While there is no way of definitely determining the number of fish reaching Quinault Lake in the course of a season, a very close estimate may be arrived at by basing it on the number taken by the Indians at the mouth of the river. This during the past year indicated one of the poorest seasons on record in the region. The run to the upper waters was 10 days late owing to low water. Many fish that collected in deep holes, apparently waiting for a rise, were taken by seining, and most of them being ripe, they were stripped where caught. The spawning season began November 10, and the total egg collections amounted to 13,395,000. Hatching was delayed a month by cold weather and snow in the mountains. A part of the young had to be released in the sac stage owing to lack of trough room. About 50,000 were held per trough until the sac was absorbed, when they were liberated down to 6,000 and these held for fingerling production. Dead eggs were removed by salt solution, and with such effectiveness that the care of the eggs required the time of only two men.

About 45,000 blueback fingerlings brought over from last year were the product of eggs from Alaska. Of these 42,502, by actual count, were marked by the removal of the adipose and left ventral fins, and liberated in August and September. The losses from marking were slight.

Blueback-salmon fingerlings were observed in Quinault Lake in much larger numbers than in the previous two years, many thousand being seen feeding in schools near the surface in May and June. Incidental to blueback fishing, there were collected 235,000 chinook

eggs which produced 160,000 fry. The run of silver salmon was the largest since the establishment of the station and contained many large males, some of them weighing 25 pounds. The egg collections of this species numbered 2,166,000, from which 1,910,000 fry were hatched and distributed. Three earth ponds, each 40 by 16 feet, were built during the year and successfully used in rearing operations. An addition of 25 feet was built to the east end of the hatchery, making it 40 by 127 feet, with capacity for 100 hatching troughs.

In the Oregon field, the egg collections of all species for the year numbered 39,941,100, and the output amounted to 35,099,392 fish and eggs. The earlier salmon-egg collections in the Columbia Basin were above the average, but there was soon a diminution, because of the redoubled efforts of commercial fishermen, who were spurred on by the higher prices paid for salmon. The operations of these men are jeopardizing the industry.

Through a technicality discovered in the law, Clackamas River was thrown open to commercial fishing after having been closed about eight years. This stream has heretofore been gaining each year, notwithstanding the strenuous fishing near its mouth and on the Willamette River. Unless there is relief within a reasonable time, it is feared that salmon fishing on the Clackamas will soon be a thing of the past.

From Clackamas station a large distribution of trout was made throughout Washington and Oregon. An autotruck, transferred from Baird station, greatly facilitated and cheapened the distribution. Shad operations were undertaken during the early summer months as usual at Willamette Falls, and two new collecting fields were opened up—one at St. Helens, on the main channel of the Willamette River, and one at Astoria, on Youngs River. Flood waters from melting snows and warm backwaters materially hampered the work, and up to the close of the fiscal year only 1,861,000 shad eggs had been secured at the three points.

At the upper Clackamas station low water prevented satisfactory runs of chinook and silver salmon. Two earth ponds were built at this point for the alternate holding of adult fishes while ripening and fry undergoing rearing. An abundant supply of water followed the introduction of a new 6-inch line.

Collections of chinook eggs for Little White Salmon station were satisfactory only at first or while the Columbia River was yet closed to commercial fishermen. Then fishing became a handicap, reducing collections to about half the amount of the preceding year, or to 17,914,000 eggs. During the long period that the Columbia River was at flood stage, the fish remained at the mouth of the river where they were captured by trolling operations of commercial fishermen. The intensity of these operations is evidenced by the fact that one concern in Astoria paid the commercial fishermen \$52,000 for the salmon taken by that method. From stripped salmon a sufficient number of carcasses were preserved to meet the food requirements of young fish. Some of the flesh was smoked, but most of it was salted. In former years these fish have been discarded. During July and August 50,000 chinook fingerlings were marked by the removal of the posterior half of the dorsal fin and the left ventral fin. The fish averaged about  $2\frac{1}{2}$  inches in length, and were not in the best

of condition. They were hatched from "fall" eggs. At this station 20 ponds of the series planned were completed in time to be utilized in the rearing of chinook fry. They are patterned after the modern series at Quilcene station, and can be emptied, thoroughly cleansed, and otherwise handled at minimum expense. The most detrimental effect of the intensive fishing for chinook salmon on the lower Columbia River was experienced at the Big White Salmon station, very few fish appearing after the first two days of the run.

At the Rogue River station, where 5,626,000 eggs of this species were collected, only 1,683,000 were obtained the year before. The run of fish was the largest ever known on that river, but only a few escaped the fishermen and ascended to waters in the vicinity of the station. These were spring run, and as no trace of a fall run reached the hatchery, it is probable that the greater part of the run was canned. The pack of two canneries at the mouth of the river exceeded anything in the past, the passage for the fish being practically obstructed by the gill nets, which were installed in every favorable eddy. The Ament dam across Rogue River again proved a serious obstruction to the ascent of salmon to the hatchery, the fishway on the north side not being in working order, while the ladder on the opposite side has never been satisfactory. Steps are being taken by the State board of fish commissioners and local sportsmen to remedy these defects. While the steelhead-egg collections were large, they were not proportionate to the number of fish in the lower river.

The first runs of fall chinook and silver salmons in Applegate Creek were nearly total failures so far as propagation was concerned. Practically all the chinook salmon were taken by commercial fishermen, and the silver salmon did not make their appearance in this field in the usual numbers. Whether this was due to the extremely low temperatures or was caused by oceanic conditions is unknown. Collections of steelhead eggs exceeded former records, nearly 6,750,000 being taken; and to relieve the congested conditions in the hatchery more than 2,000,000 were transferred to State hatcheries and to points in the East. Adult fishes, captured by means of jumping box and trap, were held in the station ponds for ripening, but the excessively cold weather retarded their development and they accumulated to such an extent that 5,000 were on hand at one time. This long retention caused a considerable percentage of the eggs to become "glassy" or "dry" and incapable of fertilization.

At several of the Bureau's Oregon stations where steelhead rearing operations were conducted, the State authorities cooperated in the work to the extent of providing funds for the feeding of the steelheads to the fingerling stage. This work was also actively supported by various anglers associations in the State.

The output of the Baird (Cal.) station and its auxiliary stations for the year numbered 22,748,250 eggs, fry, and fingerling fish, over 14,000,000 being of the latter classification. There was no run of salmon in the McCloud River at Baird. The eggs hatched at this point were transferred from the auxiliaries, chiefly from Battle and Mill Creeks, which furnished nearly 10,000,000 chinook eggs for development at Baird and the California hatchery at Sisson. Fry produced at Baird station numbered nearly 4,000,000, including 67,000 brook and rainbow trouts.

The chinook-egg collections at Battle Creek were only fair, amounting to 14,293,000. Owing to the high temperature of the hatchery water supply, the fry in course of rearing had to be liberated as early as April 11. In May chinook-salmon fingerlings to the number of 13,850 were marked at the Battle Creek hatchery by the removal of the adipose and right ventral fins; the fish were about 2 inches long, and although they were the product of the last eggs taken in the fall, they were apparently in good condition when liberated. Temporary earth ponds were utilized to relieve the hatchery of fry, the young being allowed to leave them at will.

Between October 24 and December 8, 7,026,000 chinook-salmon eggs were collected at the Mill Creek station, and several tons of stripped salmon were smoked and salted as a fish food. The young refused this food when from 6 to 8 weeks old, and as the water supply was dangerously warm, the fish were liberated and the station was closed by April 15.

The silver-salmon run at the Hornbrook hatchery was almost a complete failure and but few eggs of that species were collected. There was also a reduced run of chinooks as compared with last year. Of the 2,940,900 eggs secured, 1,000,000 were transferred to the State hatchery at Sisson, owing to partial failure of the water supply.

At the various stations on the Pacific coast and in Alaska, where the salmon fry and fingerlings were fed from five to nine times daily, a mixed diet was used. The ingredients consisted of salted salmon, smoked salmon, soluble blood meal, middlings, spleen, and liver, the principal ingredient being salted salmon. Owing to its high cost, liver was used very sparingly and only during the early stages of growth. Spleen was added for variety. Difficulty was experienced with the smoked salmon, as generally the fry refused it, and in every case where it was fed the losses were largely increased. From the results secured it is assumed that this material is not suitable for young salmon.

#### PROPAGATION OF COMMERCIAL FISHES OF THE GREAT LAKES.

The efforts put forth in the propagation of the commercial fishes of the Great Lakes were quite successful. The largest collection of lake-trout eggs in the history of the Bureau was made, while the take of whitefish and lake-herring eggs slightly exceeded the collections of last year, notwithstanding that storms interfered with the operations to a considerable extent in some of the more important fields. The only species propagated in this region which shows a material reduction in output is the pike perch, and this was caused by the abnormally late spring, the spawning grounds being heavily coated with ice at the time when the run of fish thereto usually occurs.

Late in September field stations of the Duluth hatchery for the collection of lake-trout eggs were opened up in the vicinity of the important fisheries in Lake Superior, and during October and November 25,385,000 eggs of good quality were secured and transferred to the Duluth hatchery. This being in excess of the number that could be conveniently handled and at the same time allow hatching space for other species of eggs to be accommodated later on, it was

decided to turn over 3,000,000 green eggs to the Wisconsin Conservation Commission. With the appearance of the eye-spots in February, further shipments, aggregating 1,350,000, were consigned to applicants, and from the remainder 14,955,000 young fish were hatched and distributed, most of them in Lake Superior.

Incidental to the lake-trout collections, 1,785,000 whitefish eggs were taken at the fishery near Grand Marais, Minn., and these, together with a stock of 25,000,000 green eggs of this species forwarded to Duluth from the Put in Bay field, produced 7,130,000 fry, most of which were planted in Lake Superior.

Active operations were inaugurated in Michigan waters on October 18 with the taking of the first lot of lake-trout eggs in the vicinity of Detour, Mich., and from that time until the end of November daily collections of this species were made at 1 or more of the 13 collecting stations operated from Northville. The favorable weather prevailing during the spawning period permitted almost daily attendance at the nets, and as there was a good run of fish the outcome of the operations was the largest collection of lake-trout eggs in the history of the Bureau's work. Out of a total of 86,379,200 secured, 58,889,000 were taken in the vicinity of Charlevoix, St. James, and Manistique, the yield in the remaining fields ranging from less than 200,000 at some points to several millions at others. Of this stock 32,000,000 in round numbers were laid down for hatching in the Charlevoix, Alpena, and Sault Ste. Marie substations. About 18,000,000 were furnished green to Federal and State hatcheries outside of Michigan, and all of the eyed eggs produced at Northville from the remainder, amounting to 22,507,000, were also shipped on assignment to other hatcheries. The eggs in the Sault Ste. Marie hatchery were turned over later to the Michigan Fish Commission, while from the stock incubated at the other substations named 14,662,000 were hatched and distributed on contiguous spawning grounds.

Whitefish spawning operations in the Michigan territory opened October 24, in the Detroit River, and the last eggs of the season were obtained on December 26 at Northport, Mich. From these and nine additional collecting points, located in Saginaw Bay, upper Lake Michigan, and Grand Traverse Bay, eggs to the number of 95,520,000 were obtained. Weather conditions throughout the season were reported as normal, but the catch of the commercial fishermen at all points was light, averaging not more than 50 per cent of the take in previous years. The resulting shortage in the stock of the Detroit hatchery was made up by the transfer thereto of 48,680,000 eggs taken in Lake Erie under the direction of the Put in Bay, Ohio, superintendent. The entire number yielded 100,000,000 eyed eggs, 60,000,000 of which were transferred to the Alpena and Charlevoix hatcheries with the view of distributing the resulting fry on near-by spawning grounds. The remaining 40,000,000 were hatched without loss at Detroit, and the product was liberated in the Detroit River and on other spawning beds in the lower lakes where operations had been conducted.

The gathering of pike-perch eggs for stocking the Detroit hatchery was begun April 11 in Saginaw Bay, off Bay City, Mich., and on May 5 in Munoskong Bay, an arm of St. Marys River. From these two fields 162,150,000 eggs were secured. This number was reduced by

losses to 50,250,000 eggs after the eye spots had been developed in the Detroit hatchery. In accordance with the terms of the lease granting the Bureau the use of this hatchery, 40,500,000 eyed eggs were turned over to the Michigan Fish Commission. Part of the fry hatched from the balance were planted in inland waters of Michigan and the remainder were deposited in Lake Huron, Saginaw Bay, and Detroit River.

Prior to the opening of the fishing season in Lake Erie the force of the Put in Bay station was engaged in repairs and improvements to grounds and buildings and in getting the equipment in shape for field operations. Preparations were made for conducting whitefish propagation on the largest scale commensurate with the funds available; and, in order to save every possible egg, men were detailed to the various fisheries in advance of the spawning season, in November, to see that the fishermen were supplied with all necessary utensils for taking and fertilizing eggs, and to give the uninitiated instructions as to the proper method of procedure. A force was assigned in due season to the important fisheries at the west end of the Lake near Monroe Piers to install crates for the holding of unripe fish pending the development of their eggs. However, a severe storm prevailed during November 15 and 16, just when the fish had commenced to congregate in numbers on the reefs and in the shoal waters around the shore, causing the water to recede to several feet below normal and starting such a strong current in the Lake that nearly all the commercial nets were wrecked. The fish were driven into deeper waters, where they remained so long that most of the fishermen removed their nets from the Lake, fearing to trust them out so late in the season because of the destructive effects of ice. Through the hearty cooperation of the fishermen, 2,218 partly ripe fish were obtained and penned after the storm had subsided, and the egg returns from this relatively small brood stock were satisfactory, thus redeeming the operations from complete failure which at the height of the spawning season seemed inevitable.

In other portions of Lake Erie the collections averaged up to the records of past years and in some instances exceeded them. Of the eight fields occupied, the largest measure of success was obtained at Port Clinton, Toledo, and Isle St. George, which yielded 115,760,000, 69,680,000, and 66,440,000 eggs, respectively. The collections from all portions of the Lake amounted to 357,240,000 eggs, and had the nets been in good condition after the storm it is believed the take would have broken all records, as the fish must have returned to the spawning grounds in great numbers, judging from the quantities taken in nets that were afterwards found to be badly damaged. Assignments of green eggs to State hatcheries and stations of the Bureau, aggregating 121,700,000, were forwarded direct from the fishing fields. The remainder were hatched, producing 208,500,000 fine, healthy fry for return to the spawning grounds.

As the Ohio Fish Commission was able to satisfactorily care for all eggs of the cisco, or lake herring, available in Lake Erie, no attempt was made by the Bureau's men to obtain eggs of that species, this being in accordance with an agreement previously entered into with the State authorities.

Notwithstanding the exceedingly cold and prolonged winter experienced in this region, a few warm days near the end of March sufficed



to remove all traces of the unusually heavy coating of ice on the pike-perch spawning grounds, and the fishermen were able to install their nets earlier than for several years past. Rough weather prevailed during the first few days of April, however, making it impossible to fish until the 7th, when a lot of eggs came in from the Port Clinton field. From that time on daily collections were received until the close of the spawning season on May 6. The weather conditions during this period were generally favorable, and the results of the work were satisfactory, 611,250,000 eggs being secured, or about 20,000,000 in excess of any season's collections on this lake since the spring of 1911. Green eggs to the number of 166,200,000 were shipped on application, leaving 445,000,000 to be laid down in the Put in Bay hatchery. After the development of the eye spots 52,000,000 additional eggs were utilized in filling assignments and from the remaining stock 115,500,000 vigorous fry were hatched, nearly all of which were returned to Lake Erie.

Fish-cultural work at Cape Vincent opened October 18 with the receipt of small lots of lake-trout eggs from Galloo and Stony Islands, in New York waters, and from the commercial fisheries near Pigeon Island, Ontario. The collections were interfered with by prevailing high winds, and, as a consequence, only 762,000 eggs were secured from the entire Lake Ontario field. To make up for the shortage in lake-trout eggs for this hatchery, 9,400,000 green and 1,750,000 eyed eggs were forwarded from Michigan. From this stock 6,315,000 fry were hatched which, with the exception of 179,000 furnished to New York applicants for stocking interior waters, were all liberated in suitable parts of Lake Ontario.

During the fall of 1916 arrangements were made by the superintendent of Cape Vincent station to cooperate in whitefish propagation with the New York Conservation Commission at Old Fort and Upper Saranac, N. Y., and to collect independently from commercial fisheries in the vicinity of the station, at Three Mile Bay and Chaumont Bay, N. Y.; also on the Canadian side of Lake Ontario around South Bay. This latter field, which had never before been canvassed by the Bureau, proved fairly productive, yielding 12,550,000 eggs, and had a suitable boat been available it is believed the collection there would have been several times larger. Under existing conditions the eggs had to be hauled many miles overland, then shipped by rail to Kingston, Canada, and from there to the hatchery by boat, notwithstanding the fact that the fishery is only 20 to 25 miles distant from Cape Vincent. The Bureau's share of eggs secured as a result of cooperative work with the State amounted to 12,048,000, and 4,280,000 were obtained from commercial fishermen in New York waters, bringing the total collections to 28,878,000, or sufficient for stocking the hatchery without resorting as in past years to the transfer of eggs from outside stations of the Bureau. Fair success was attained in hatching these eggs, and in making the distribution the 19,550,000 fry produced were equitably divided between the spawning grounds in Lake Ontario and the interior waters of New York.

In the course of the whitefish spawning season, which was coincident with that of the Lake herring, extending from November 10 to December 5, eggs of the latter species to the number of 115,575,000 were collected and hatched, yielding 82,550,000 fry for return to the

spawning grounds. Over four-fifths of these were taken in the vicinity of Sodus Point, N. Y., and more might have been secured there had hatching space for handling them been available.

In connection with the propagation of commercial fishes, the usual numbers of young brook and rainbow trouts were hatched at Cape Vincent, the eggs having been furnished from outside sources.

In advance of the spawning of the pike perch in April, trap nets for the capture of brook fish were set in the Oswegatchie River within the corporate limits of Ogdensburg, N. Y., with the intention of conducting spawning operations in cooperation with the New York fisheries authorities. However, for some unknown reason, the catch of fish was only about one-third as large as last year, when operations were conducted on the same stream. This resulted in a proportionate decrease in egg collections, the total deliveries at the hatchery amounting to only 21,312,500, or less than one-third the number obtained in 1916. The fry hatched numbered 10,875,000, and after providing for a proper return to the spawning grounds the remainder were shipped to applicants in New York and Pennsylvania.

During the spring of 1917, 31,350,000 yellow-perch eggs were collected from brood fish obtained by setting nets in the river near the hatchery and 26,000,000 were hatched. With the exception of 250,000, which were used to fill applications, all of the fry resulting from this work were returned to the river.

The experience of recent years having demonstrated that pike-perch propagation could be more successfully and economically conducted on the shores of Lake Champlain than at the established location on the Missisquoi River, steps were taken early in the fiscal year to take down the Swanton hatchery and rebuild it on a selected site at Sandy Point, on Missisquoi Bay. All of the old material was utilized in the new construction, which was erected on a cement foundation and provided with a cement floor into which two large fry receiving tanks were built. The hatching capacity of the new building was increased by about 100 jars, and an abundant water supply by pumping was arranged for by extending the suction pipes directly into the lake. As funds were not available for completing the hatchery in all its details, only such part of the construction was planned for as would permit of the propagation of pike perch during the spring, with the view of adding the finishing touches later on.

The cold, backward spring and the presence of ice in the lake and river about one month later than usual were mainly responsible for the poorest spawning season that has been experienced in this region for some years. Such conditions have always been found to seriously curtail the run of spawning pike perch, this being especially noticeable in 1913, when practically no females entered the river. That year, however, they were taken from the lake, but during the past spring the fish did not seem to congregate on the lake spawning grounds at all.

In the belief that the old method of securing a brood stock from commercial fishermen entailed more expense than necessary, the station superintendent engaged the services of an expert web worker from the Lake Erie field for the construction of a trap net, to be operated by the station force. After a trial it was decided that the net could not be worked in the river successfully owing to its frequent

obstruction by floating débris. An effort was then made to operate it on a flat at the mouth of the stream, and here a considerable number of brood fish were taken. As a result of the season's experiments with this net it was decided to construct several more on the same lines, equip them with proper leads, and depend upon this method in the future for securing a brood stock, arranging for their operation in close proximity to the hatchery. Only 39,150,000 eggs were taken, and the percentage of hatch was somewhat below the average. However, this is not attributed to the poor quality of the eggs, but is believed to have been wholly due to the imperfect and untried conditions encountered in the new location. A few fry were retained for filling local applications, but the bulk of the output was planted near the station in Missisquoi Bay.

The collection of eggs was deemed too small to warrant the resumption of the field hatching operations inaugurated last year at Burlington, Vt. In lieu thereof the State Fish Commission undertook collections from the Lamaille River with equipment loaned by the Bureau, and the 32,500,000 eggs secured were eyed in the Sandy Point hatchery and then transferred by the State authorities to Burlington to be hatched and distributed locally in Lake Champlain waters.

After completing the collection of pike-perch eggs, 20,000,000 eggs of the yellow perch were taken for filling applications. The applicants for this species were so scattered that it was found impracticable to supply all of them during the short period that fry were available. Therefore a certain proportion of the fish were placed in a small pond at St. Johnsbury station, with the view of forwarding them to the more distant applicants in connection with the black-bass distributions later in the season.

#### PROPAGATION OF MIGRATORY FISHES OF THE ATLANTIC RIVERS.

The results of the shad season on the Potomac River were decidedly encouraging, there being a fair catch of fish and an abundance of eggs of good quality available for hatching. On the other hand, the efforts put forth at the Edenton (N. C.) station were practically fruitless, the collection of shad eggs being the smallest in the history of the Bureau's work in that region.

In advance of the shad hatching season the Bryans Point station was engaged in the propagation of yellow perch. In preparation for that work, 25 live cars were anchored in the mouth of a convenient creek for the reception of a brood stock, which was obtained by making daily visits to the nets of the commercial fishermen operating in neighboring streams and purchasing all available specimens. In this way 14,874 were acquired during March and installed in the live cars, where eggs to the number of 141,740,000 were dropped and bailed up for development in hatching jars between March 23 and April 3. Having finished spawning, the brood fish were released in local waters. The crop of eggs produced 130,370,000 vigorous fry for return to the spawning grounds.

During the mild weather of early April, shad appeared on the spawning grounds in numbers, and the fishermen made good catches until April 8. From that date until April 15 cold and stormy weather prevailed, and the water temperature dropped from 53° F., April 1 to 44° F., April 10. On April 17, when the temperature rose to 54° F., the catch was again good and the first eggs of the season

were taken. Two days afterward vigorous collecting efforts began, and were sustained to the close with average collections for the last 12 days of April closely approximating 4,000,000 eggs, the month's aggregate being 47,196,000. Despite the fact that high northwest winds prevailed during May and the water temperatures were rather low for successful work, the daily average of egg collections for the month was 1,225,000, and the total for the season amounted to 77,580,000, exceeding last year's total by nearly 15,000,000. Of this product, 1,899,000 eggs were transferred to the Washington aquarium of the Bureau for an exhibit, and from the remainder 68,665,000 fry of good quality were hatched and liberated on the Potomac River spawning grounds. The relatively large fry production was made possible by delaying the measurement of the eggs until the second day after their installation in the hatchery, thereby eliminating at the outset virtually all that were infertile, injured, or otherwise defective. The egg-collecting period ended on May 25, and the work of planting the fry, dismantling and storing equipment, and closing the hatchery was completed by May 31.

During the early part of the fishing season in Albemarle Sound, the prospects were favorable for one of the best runs in many years, but as it turned out very few fish reached their spawning grounds in its upper reaches and the Edenton station experienced one of the poorest years in its history. The sound was monopolized throughout the shad-spawning season by pound-net fishermen, practically none of whom were willing to cooperate with the Bureau in its efforts to save eggs. It is customary for these men to fish their pounds during the morning hours, and as the bulk of their catch is herring, it is necessary that the nets be hauled at frequent intervals and the fish prepared for salting. When requested to fish during the hours from 4 p. m. to midnight they objected on the ground that no labor would be available during those hours for dressing their herring. Only 7,625,000 eggs were taken and 6,060,000 fry hatched.

While satisfactory cooperation of the fishermen was lacking, the second year of white-perch propagation at Edenton station was an improvement over the first attempt, the egg collections aggregating 41,925,000 and the fry production 32,625,000.

There was increased cooperation on the part of the fishermen at the striped-bass auxiliary of the Edenton station, at Weldon on the Roanoke River, and the operations were highly successful as compared with results of former seasons. The first eggs were gathered April 23. Rising water, in conjunction with cold weather on May 5, arrested collections from that time until May 17, after which some eggs were taken daily until May 24, when the river had become so low and clear that the fish departed for deep water and the work had to be discontinued.

A feature of the work in this field was the holding of male fish in boxes at a midway river point for use when eggs were found and only females caught. Over a third of the eggs collected were saved through this arrangement. The egg collections for the season numbered 19,049,000, which yielded an output of 16,137,000 fry for return to the spawning grounds in the Roanoke River.

The second year's effort to hatch shad at auxiliaries of the Orangeburg (S. C.) station on the Edisto River was a failure so far as actual numbers were concerned. While there was no scarcity of adult fish,

very few were caught in a spawning condition. Between March 15 and April 30 the production of fry at the Jacksonboro field hatchery amounted to 145,000 and at Branchville 125,000; both lots were liberated on the spawning grounds in the Edisto River.

The propagation of Atlantic salmon at the Craig Brook (Me.) station was prosecuted to the same extent and along the same lines as heretofore. At the beginning of the year 968 wild adults of this species, purchased during the preceding two months, were being carried in the station inclosure awaiting the development of their eggs. By spawning time in October the number had shrunk through losses in the pound to 887, of which 491 were females. From this stock 3,739,180 eggs were secured, 3,404,258 fry hatched, and 3,028,858 young fish distributed, the discrepancies in the numbers showing the losses sustained through the incubation and fry stages. The entire output of this species was liberated, as formerly, in tributaries of the Penobscot River, the distribution occurring in May. At the close of the fiscal year 835 adult fish to be used as a brood stock for next season's supply of eggs were on hand in the station inclosure.

During May and June 28,250,000 smelt fry were produced at the Green Lake station, the eggs having been derived from a run of brood fish in the vicinity. The output would no doubt have been much larger had not a cold heavy rain occurred just at the beginning of the spawning season, reducing the temperature in the brooks and causing the run of fish to drop back into the lakes below, where many of them were badly bruised on the sandbars in their attempts to spawn. Fifteen million eggs were taken from a second run, and the remainder of the collections were gathered on the gravel beds where the fish had congregated in the lakes. In making the distribution preference was given to waters in the State which the Maine fisheries authorities are especially desirous of stocking.

A shipment of humpback-salmon eggs forwarded from the Afognak (Alaska) station arrived at the Craig Brook and Green Lake stations on November 17. The eggs laid down at the former, numbering 4,096,000, were in fine condition and the fry hatched from them were liberated in March in tributaries of the Penobscot, the entire loss on both eggs and fry during the time they were held amounting to only 134,561. Excellent results were also attained with the Green Lake assignment. From the 4,106,752 eggs received fry to the number of 3,950,150 were hatched and distributed, the rivers selected for the plants being Dennys, St. Croix, East Machias, Narragausgus, and St. George, all of them coastal streams in the State of Maine.

#### OPERATIONS OF THE INTERIOR STATIONS.

The total number of trout produced for distribution for the fiscal year, including brook, blackspotted, and rainbow, amounted to 25,411,669, or an excess of 2,298,227 over the output of those species in 1916.

The brook-trout operations at Leadville station were unusually successful, both as to the number of eggs taken and the results attained during the hatching and distribution period.

The hatchery at Berkshire, Mass., recently donated to the Bureau, yielded an output of 256,995 brook trout, 179,995 of which were fingerlings.

The stations showing increased production of brook trout over last year were those at Cape Vincent, Clackamas, Duluth, and Nashua. Some losses occurred at the Erwin station owing to the poor quality of eggs obtained from commercial dealers.

At the Hornbrook auxiliary of the Baird (Cal.) station, 205,650 rainbow-trout eggs were collected from wild spawners during the spring.

In an effort to improve the brood stock of rainbow trout at eastern stations of the Bureau, a consignment of eggs from wild fish, of extra large size, was forwarded from collecting fields in the vicinity of Bozeman to Wytheville during the spring, with the view of distributing the resulting fry to the various rainbow stations in the East to be reared for breeders.

There was an aggregate output of 10,250,465 basses, crappies, sunfishes, and catfishes, this being a slight increase over the 1916 distribution. The yield of black bass was greatly curtailed at a number of stations by cold weather during the spring which caused the brood fish to abandon their nests.

The closure of the San Marcos station, owing to the failure of the Texas Legislature to enact legislation favorable to the Bureau's work in that State, reduced the output of the station from 370,925 in 1916 to 90,656 in 1917.

At the Bullochville (Ga.) station a half-acre pond was treated with quicklime in March for the purpose of stimulating aquatic plant life, so essential in pond cultural operations. Brood fish to the number of 56 nested in the pond thereafter, and it is believed that the experiment will have a favorable outcome.

At Odell and Meadow Creeks field stations, in Madison Valley, Mont., 995,000 rainbow-trout eggs were collected during April and May, and in May and June eggs of the grayling to the number of 2,800,000 were secured. This work was seriously hampered by high water, which permitted the fish to escape from the main channels of the streams into numerous small rivulets, where they were inaccessible for propagation. As a consequence egg collections of both species were greatly curtailed as compared with past seasons. After providing for the return to the spawning grounds of a sufficient number of fry for the maintenance of the stock therein, the balance of the eggs were shipped, some as eyed eggs on assignment, and some to the Bozeman station with the view of utilizing the product in filling applications for young fish.

The spawning season of the blackspotted trout in the Yellowstone National Park ordinarily extends from the latter part of one fiscal year into July or August of the next, the fish on the west side of Yellowstone Lake usually spawning during June and on the opposite side in July. During July, 1916, the egg collections in this region aggregated 7,400,000, all of which were taken from fish that had ascended tributary streams to spawn. The fish were seined from below racks or barriers that had been installed for their interception, and held in live cars for ripening. All of the eggs were eyed in the park hatchery and then transferred, part to various stations of the Bureau, and part to various State fish hatcheries. In the spring of 1917 the work was resumed, and eggs amounting to 440,000 were secured from the Soda Butte field.

## PROPAGATION OF MARINE SPECIES.

Taken as a whole, the output of the marine stations exceeded that of 1916 by more than half a billion fish and eggs. Owing to conditions over which the Bureau had no control, the volume of the lobster and cod operations was somewhat lessened in comparison with the previous year, but the shortage in that direction was compensated for by the largely increased production of pollock and flatfish.

On account of the limited funds available and the excessively high cost of lobsters, only 14,660 adults were purchased as a source of egg supply for the Boothbay Harbor station, this being a smaller stock by several thousand than had usually been secured for that purpose. The lobsters were acquired and installed in the pound between July 1 and September 30, and during succeeding months they received the close attention of a caretaker who fed them regularly, maintained a uniform water temperature in warm weather by opening and closing the gate valves of the pound at a specified time each day, and guarded against pollution by the removal of all débris from the inclosure at frequent intervals. In April the stock which was in the pound was transferred to live cars at the hatchery until the lobsters could be relieved of their eggs, after which they were turned over to the Maine Department of Fisheries.

Those surviving confinement amounted to 10,976, or nearly 75 per cent of the original number, which shows merely an average loss, considering the long term of confinement to which they were subjected. It was found there had been an appreciable loss of eggs through premature hatching in the pound, and there were indications that some of the barren lobsters had been stripped by eels, notwithstanding the vigilant efforts made to prevent this by the regular setting and tending of baited eel traps. In the course of the year many large eels were caught in this way, but it was impossible to capture the small ones. On account of the losses mentioned, only 104,445,000 eggs were realized, the average per lobster being 9,516, or slightly less than that of last year. The percentage of eggs hatched was 98. The fine quality of the fry is justly attributable, in part, to the adoption of large, flat, wooden baskets for removing them from the pound, thus reducing the amount of handling that has heretofore been required. In the future it is intended to use these baskets exclusively, not only when unloading the pound but when making transfers thereto. During the spring months all available "seeders", amounting to 237, were purchased and from this source 5,615,000 additional eggs were obtained.

On March 1 fyke nets were set in waters adjacent to the Boothbay Harbor hatchery, and from that time to the close of April the force was busily engaged in acquiring a brood stock of flatfish. To this end new fishing grounds were resorted to, and extended collections were made in Casco Bay and farther westward by means of the station steamer. The total number of brood fish obtained from all sources amounted to 7,775; these yielded 1,085,326,000 eggs from which 966,266,000 fry were hatched, a percentage of 89. The fry were liberated in the usual manner, and in waters near where the fish had been caught.

As in past years an experimental shipment of pollock eggs was made from the Gloucester station by means of the steamer *Gannet*,

which was equipped for the purpose with jars, cans, and other apparatus. The trip was completed December 11, on which date 7,381,000 live eggs, out of an original consignment of 34,430,000, were delivered at the station. In connection with this shipment, and also those made on previous occasions, every possible attention had been given the eggs en route; the water was changed at frequent intervals, and the eggs were packed and handled by different methods. In view of the extremely poor results attained, it can only be concluded that it is not practicable to transport long distances such delicate, sensitive eggs as those of the pollock. From the eggs received only 3,346,000 fry were obtained for distribution.

During the fall the superintendent purchased a carload consignment of 6,420 lobsters, had them prepared under his direction for transfer to the Pacific coast, and personally accompanied the shipment. The trip across the continent consumed less time than in former years, and the results were very encouraging, there being a loss of less than 10 per cent and all of the survivors being liberated in most excellent condition.

At the beginning of the fiscal year, comparatively small numbers of lobster and mackerel eggs were undergoing incubation at the Gloucester station, and additional collections of these species and of the butterfish were obtained, hatched, and distributed during July.

Pollock propagation was undertaken on November 1, 1916, under conditions which it was feared would greatly handicap the work. The schooner *Grampus*, whose crew had for 20 years acted as spawn takers for the station, was assigned to other duty, making it necessary to train a new force of men to take spawn. The results of this change were noticeable at first, but by the time eggs were available, in large numbers, the character of the work of the new men had materially improved. Between November 1 and January 27, 2,081,000,000 eggs were taken, and during the height of the season, in December, when the daily collections frequently reached from 50,000,000 to 100,000,000, and on one occasion to 161,000,000 eggs, the hatchery became so crowded that it was necessary at times to plant the oldest eggs in the house to provide room for new acquisitions. The total number disposed of in this manner aggregated 614,530,000, all of which were deposited in open waters off Cape Ann. One shipment of 34,430,000 was forwarded to Boothbay Harbor station and the remainder produced 856,220,000 fry, which were distributed along the Massachusetts shore from Rockport to Marblehead. From the close of the pollock season, near the end of February, the weather was too cold for successful egg collections. During that period Gloucester Harbor was completely frozen over for several days as far as the breakwater at its entrance, and as the station was short of fuel the entire force, including the spawn takers, was utilized in carrying coal from Rocky Neck to the hatchery, using an old sleigh and small hand sleds for transporting it over the ice.

Between February 27 and April 13, 1917, 92,340,000 cod eggs were taken at Gloucester, yielding 62,790,000 fry, which were planted in adjacent waters. In addition 3,820,000 cod fry were developed from a shipment of eggs forwarded to Gloucester from the Woods Hole station, during a period of congestion in that hatchery. Egg-collecting operations were seriously curtailed during March and April by the spring freshets. Cod eggs in abundance were available at



that time, but the sea water all along the New England coast, for 15 to 25 miles offshore, was freshened to such an extent that very heavy and sometimes total losses occurred when eggs were carried in it. The haddock as well as the cod were affected by it, and many of the haddock eggs died in transit to the station. The total collections of haddock eggs were 10,820,000, which yielded an output of 6,720,000 fry.

Practically all of the 340 brood flatfish secured for the station were taken in fyke nets set during March in Gloucester Harbor, the attempts to obtain additional supplies in Ipswich Bay and in the vicinity of Salem being unsuccessful. From this stock 191,250,000 eggs were derived and 169,660,000 fry were hatched and planted, the distributions being made in the harbors and coves of Ipswich Bay and Massachusetts Bay.

Active fish-cultural operations for the season at the Woods Hole station began with the acquisition of the first lot of brood cod, on November 21, and from that time until December 1 purchases of these fish aggregating 3,155 were made daily from commercial fishermen. This appeared to be the best brood stock the station had had for several years, but from a fish-cultural standpoint it proved to be disappointing, as the number of males and barren females contained in the lot was disproportionately large, resulting in a smaller yield of eggs by 48,000,000 than that of the previous year, and a reduction of 23,000,000 in the output of fry. Eggs to the number of 238,630,000 were obtained from these fish between November 28 and February 25; the height of the spawning season occurred in December. On one occasion during December the hatchery became overcrowded, necessitating the transfer of a consignment of 6,810,000 eggs to the Gloucester station for development. The losses sustained in hatching aggregated 61,642,000, or about 26 per cent of the stock retained. After having finished spawning, the surviving brood stock, numbering 2,648 fish, were liberated on March 1. The distribution of the fry extended from December to March, inclusive.

In advance of the flatfish spawning season, additional hatching equipment was constructed, with the view of increasing the output of this species over that of last year. However, this proved to be impossible owing to the difficulties encountered in securing a brood stock. Before fyke nets for the capture of this fish could be installed in Waquoit Bay, ice 7 inches in thickness had to be sawed out, and a second sawing was necessitated in order to effect their removal. In other places floating ice, shifted by wind and tide, covered the nets and rendered them inaccessible. The collections at Menemsha Pond were greatly hampered by scarcity of fish, despite the fact that more were available at that point last year than could be accommodated at the Woods Hole hatchery, and some 500 barrels of flatfish were taken from the pond by commercial fishermen.

The effort to obtain brood flatfish in Narragansett Bay met with a larger measure of success than at either of the other fisheries, notwithstanding the operations were materially interfered with by the high winds, which not only put many of the nets out of commission but caused the loss of approximately 60,000,000 eggs by washing them out of the live cars where the brood stock had been stored. From all three fields 2,787 male and female fish were taken. Although strong

winds were quite prevalent during the hatching season, they were not from a direction that causes extremely roily water in the harbor. The losses during the incubation period were therefore light as compared with some years when more favorable conditions have been encountered, and from the 856,002,000 eggs realized 678,770,000 fry, or 79 per cent, were hatched.

#### RESCUE OF FISHES FROM OVERFLOWED LANDS.

The rescue of food fishes from temporary ponds and sloughs bordering the Mississippi and Illinois Rivers was vigorously prosecuted in the fields formerly operated near Bellevue and North McGregor, Iowa; Homer, Minn.; La Crosse, Wis.; Meredosia, Ill.; and Friar Point, Miss.; and a new collecting base was established at Galena, Ill., the returns from which were very encouraging.

Warm weather in August and early ice formations in November shortened the season in the upper Mississippi River, while operations at Meredosia were hampered by high-water stages in the Illinois River during July and August, at the very time when this work can usually be prosecuted to best advantage. Another unfavorable feature at this station was the excessive heat almost daily in July, which made the handling of the rescued fish very difficult. Owing to these conditions the aggregate collections of 8,818,160 at all points were about 3,000,000 less than those of the preceding year. As in past years, the majority of the rescued fishes were returned to the main river channels, and a limited number were used to supplement the black-bass distributions from the pond-fish cultural stations of the Bureau.

The salvaging of fishes from the overflowed lands can and should be very greatly extended throughout the Mississippi Basin. The comparatively slight attention given to the matter by the States emphasizes the necessity of Federal aid in ameliorating or preventing the enormous annual losses to which the best food fishes of the region are subject.

#### PLANTS IN CONNECTION WITH FISH-CULTURAL EXPERIMENTAL WORK.

In addition to the work of mussel propagation carried on by the fisheries biological station at Fairport, Iowa, experiments of a practical nature relating to the propagation and rearing of useful fishes are also conducted. The result is the production of large numbers of fishes, not all of which are required in experimental work, the surplus being liberated in public waters, usually in the vicinity of Fairport. The following table gives the number of each species distributed in 1917 and the age at which planted. These figures are included in the general tables of distribution which appear elsewhere.

Species.	Fry.	Fingerlings.	Total.
Largemouth black bass.....		3,525	3,525
Sunfish.....		45,137	45,137
Crappie.....		18,300	18,300
Buffalofish.....	6,750,000		6,750,000
Carp.....	112,000		112,000
Catfish.....		141	141
Total.....	6,862,000	67,103	6,929,103

## ACCLIMATIZATION.

In continuance of the attempt undertaken four years ago to acclimatize the humpback salmon in eastern waters and to establish an annual run of that species in Puget Sound, 16,000,000 eggs which had been collected near Afognak, Alaska, were forwarded from that point during the fall of 1916. On arrival at Seattle, about half of the consignment was reserved for development at the Birdsvew, Quilcene, and Duckabush stations. The remainder of the eggs were shipped to Maine, arriving there November 17, and were divided between the Green Lake and Craig Brook stations. They were hatched at both stations with merely nominal losses, and the fry were distributed, in excellent condition, in the coastal rivers of Maine; points of deposit as near the headwaters of tributary streams as possible being selected for their liberation, the object being to guard against the destruction of the young fish by entrance into brackish water before reaching a suitable age. The eggs retained at the coast stations were also successfully hatched and planted.

A number of years ago the Bureau began the annual shipment of eastern lobsters to the State of Washington, in the hope of being able to establish this valuable crustacean in Puget Sound waters. In pursuance of this undertaking, a carload consignment of 6,420 adult male and female lobsters was forwarded from Bath, Me., to Anacortes, Wash., in November, 1916. This proved to be the most successful shipment of the kind that has so far been made, the total losses en route being less than 10 per cent. The lobsters, in excellent condition, were planted soon after arrival in the vicinity of Rosario, Orcas Island, one of the San Juan group.

In November, 1916, a lot of eyed eggs of the ayu, or dwarf salmon, which had been forwarded through the courtesy of the Japanese Government, was received at the Birdsvew (Wash.) station. These eggs, which are very small and somewhat adhesive, were transported in water. En route more than 50 per cent had hatched, and the fry, as well as most of the remaining eggs, were dead. The few live eggs hatched within a short time after being removed from the hatching boxes, but as the station had no equipment for handling such small fry, they quickly passed through the smallest mesh material available, and no opportunity was afforded to observe them.

## RELATIONS WITH THE STATES.

The Bureau's constant aim and practice are to cooperate with the fishery authorities of the various States in every feasible manner. This cooperation is most widely exhibited in the matter of providing fish eggs for incubation in the State hatcheries, the resulting young to be distributed under State auspices, and of furnishing young fish to be similarly planted.

A list of the States to which, on request, the Bureau, in 1917, supplied fish eggs and fish of the species and in the numbers indicated follows.

ASSIGNMENTS OF FISH EGGS AND FISH TO STATE FISH COMMISSIONS, FISCAL  
YEAR 1917.

State and species.	Eggs and fry.	Fingerlings, yearlings, and adults.	State and species.	Eggs and fry.	Fingerlings, yearlings, and adults.
California: Chinook salmon.....	7,027,300	.....	New Jersey—Contd.		
Illinois:			Steelhead.....	100,000	.....
Black bass.....		7,000	New York:		
Brook trout.....	50,000	.....	Lake trout.....	5,490,000	.....
Catfish.....		10,500	Landlocked salmon.....	25,000	.....
Crappie.....		300	Pike-perch fry.....	6,600,000	.....
Pike perch.....	15,000,000	.....	Steelhead.....	500,000	.....
Rainbow trout.....	50,000	.....	Yellow-perch fry.....	250,000	.....
Sunfish.....		4,000	North Dakota:		
Whitefish.....	5,000,000	.....	Pike perch.....	3,000,000	.....
Yellow perch.....		250	Steelhead.....	100,000	.....
Indiana: Pike perch.....	15,000,000	.....	Ohio:		
Iowa:			Lake trout.....	600,000	.....
Brook trout.....	50,000	.....	Pike perch.....	73,600,000	.....
Lake trout.....	100,000	.....	Whitefish.....	40,980,000	.....
Pike perch.....	40,000,000	.....	Oklahoma:		
Kentucky:			Black bass.....		70
Black bass.....		88	Catfish.....		10
Chinook salmon.....		6,000	Rock bass.....		80
Crappie.....		2,800	Sunfish.....		90
Pike-perch fry.....	5,000,000	.....	Yellow-perch fry.....	100,000	60
Rainbow trout.....		10,000	Oregon:		
Rock bass.....		1,050	Blackspotted trout.....	250,000	.....
Sunfish.....		4,200	Blueback salmon.....	2,000,000	.....
Maine:			Chinook salmon.....	163,900	60,000
Brook trout.....	100,000	.....	Lake trout.....	1,000,000	.....
Lake trout.....	200,000	.....	Silver salmon.....		10,000
Landlocked salmon.....	401,000	.....	Steelhead.....	1,687,600	.....
Massachusetts: Catfish.....		12,500	Pennsylvania:		
Michigan:			Lake trout.....	1,000,000	.....
Grayling.....	50,000	.....	Rainbow trout.....	50,000	.....
Lake trout.....	8,640,000	.....	Pike perch.....	8,000,000	.....
Pike-perch eggs.....	40,000,000	.....	South Dakota:		
Pike-perch fry.....	2,000,000	.....	Blackspotted trout.....	30,000	.....
Whitefish fry.....	250,000	.....	Brook trout.....		23,150
Minnesota:			Pike perch.....	3,000,000	.....
Lake trout.....	3,300,000	.....	Utah: Blackspotted		
Steelhead.....	200,000	.....	trout.....	100,000	.....
Whitefish.....	122,500	.....	Vermont:		
Missouri: Rainbow trout.....	98,400	.....	Channel catfish.....		100
Montana:			Lake trout.....	1,500,000	.....
Black bass.....		7,500	Landlocked salmon.....	40,000	.....
Blackspotted trout.....	400,000	.....	Steelhead.....	200,000	.....
Catfish.....		2,000	Washington: Black-		
Rainbow trout.....	150,000	.....	spotted trout.....	200,000	.....
Whitefish.....	300,000	.....	Wisconsin:		
Nebraska: Pike perch.....	9,800,000	.....	Lake trout.....	13,000,000	.....
Nevada: Brook trout.....	150,000	.....	Whitefish.....	5,000,000	.....
New Hampshire:			Wyoming:		
Brook trout.....	50,000	.....	Blackspotted trout.....	300,000	.....
Landlocked salmon.....	25,000	.....	Lake trout.....	200,000	.....
Rainbow trout.....	100,000	.....	Rainbow trout.....	100,000	.....
New Jersey:			Steelhead.....	100,000	.....
Rainbow trout.....	50,000	.....	Total.....	a 322,930,700	163,248
Smallmouth black bass.....		1,500			

a Includes 14,230,000 fry.

The Minnesota Game and Fish Department donated 25,000,000 pike-perch eggs which were consigned to the Duluth station.

CLOSURE OF FISH HATCHERIES.

During the year the Secretary, acting under the mandatory provisions of law, has closed two fish hatcheries, located at Havre de Grace, Md., and San Marcos, Tex. The Secretary's action in each case was based on the recommendation of the Commissioner of Fisheries, and no date was set for reopening the stations.

The conditions which necessitated the closing of the Battery shad hatchery at Havre de Grace, at the mouth of the Susquehanna River, are set forth in a report by the Commissioner to the Secretary on January 27, 1917, from which the following extracts are taken:

The possibility that the Bureau might be driven to this step has been appreciated by you for nearly four years. Each season in that period the condition of the fisheries at the mouth of the Susquehanna has been taken under consideration with reference to our fish-cultural work. In annual reports, in special reports to members of the legislature, in communications to the governor, in press notices to the fishermen and the general public, and in personal statements and appeals, we have shown the necessity for a radical change of policy on the part of the State of Maryland in order that the further depletion of once valuable fisheries might be arrested and the abundance of important food fishes might be restored and maintained. Nothing has been done to improve the situation. The State continues to permit practices known to be inimical to the best interests of the fisheries and directly antagonistic to the efforts of the Bureau of Fisheries in behalf of the people of the State. The future expenditure of effort and money under the circumstances is not only inadvisable and unjustified, but is clearly forbidden by the following stipulation which Congress has wisely placed on our annual appropriations for the propagation of food fishes:

"No part of the appropriation herein for propagation of food fishes shall be expended for hatching or planting fish or eggs in any State in which, in the judgment of the Secretary of Commerce, there are not adequate laws for the protection of the fishes."

The Government has been conducting shad-cultural operations at Havre de Grace since 1877, and has occupied the present site since 1880. Owing to its favorable location and the cordial cooperation of the fishermen, the hatchery was able to save the spawn of a very large percentage of the ripe shad caught for market, and the output season after season tested the full capacity of the plant. In fact, this hatchery has a record of young shad produced that is not approached by any other; and the abundance of fish was assured year after year, notwithstanding an enormous catch. Gradually the methods of fishing have undergone a change and there has arisen a new generation of fishermen apparently indifferent to the needs of the shad, forgetful of their own interest, disinclined to cooperate with the Government, and insisting on the use of methods that are contrary to the interests of the State and of its people. The legislature, with the weight of evidence and testimony available regarding the obnoxious fishing methods, would be justified in summarily suppressing them as a nuisance; they remain unaltered. There is thereby placed on the Federal Government a task that yearly becomes more difficult, more expensive, and more unsatisfactory to all persons having the welfare of the fisheries and the fishermen at heart.

In the earlier years cited, the average cost of collecting and hatching shad eggs at Havre de Grace was well under \$100 per million. In 1915 the cost exceeded \$1,940 per million, and during the past three seasons has averaged \$1,216 per million, or more than twelve times the former cost.

The entire history of the hatching operations on the Susquehanna shows that the Bureau has spared no effort and expense to aid the fisheries and maintain the supply of Maryland's most important food fish. I would favor the resumption of our operations as soon as the State gives evidence of a due appreciation of the Government's work by the enactment of laws placing proper restrictions on the fishing.

The situation at San Marcos was somewhat different from that at Havre de Grace in that two stipulations imposed by Congress in relation to the fish-cultural work of the Bureau were being violated. The matter was formally presented by the Commissioner to the Secretary in May, 1917, and the Secretary thereupon issued a closing order, accompanying it with a public statement from which the following is an extract:

It is with deep regret that I have been obliged to close the fish-cultural station at San Marcos, Tex., because of the failure of the State to meet the conditions imposed by Congress. These conditions are (1) that the State shall afford proper protection to the fishes cultivated and (2) that the Commissioner of Fisheries and his duly authorized agents shall be accorded the right to conduct fish-cultural work and all operations connected therewith in such manner and at such times as they may regard as necessary and proper.

The principal fish cultivated at the San Marcos station is the largemouth black bass, the most important of the fresh-water fishes of Texas. The Department has for

years been calling the attention of the State to the fact that this species is not protected during the spawning season, but may be caught and killed even when the parent fish are on their nest guarding their eggs and defenseless young. Such disregard for the elemental needs of the fish nullifies the work of the Bureau of Fisheries and indicates an indifference to the future welfare of the fisheries and fish supply that is in strong contrast to the attitude of other States. The necessity for amending the local fish laws was actively urged on the State by the Department during the years 1915, 1916, and 1917, is acknowledged by the State fishery officials, has been pointed out by numerous public-spirited citizens, and has received the favorable consideration of committees of the State legislature. At the recent regular and extraordinary sessions of the legislature strong representations were made to the legislature and the governor by citizens, by Department officials, and by members of the Texas delegation in Congress, but the legislature failed to act.

The other phase of this matter was (a) the assertion by the Bureau of the supposed right to take fish for brood purposes, rearing, and distributing, from the head of the San Marcos River, in accordance with a distinct agreement with the local utilities company, that controlled the water and with a citizens' committee which acted for the town of San Marcos, at the time the station was located there in 1893; and (b) the recent denial by the townspeople and the local legal officers of the right of the Bureau's agents to take fish from the shut-off head of the San Marcos River that, from the very outset, had been regarded as a part of the station's nursery system. Fortified by an opinion of the attorney general of Texas, the local county attorney gave notice that the continuance of operations in the water in question would be followed by prosecution of the Bureau's representatives. The Bureau could not consent to abandon operations it regarded as rightful nor to subject its employees to arrest, imprisonment, and possible fine and conviction, for carrying on disinterested work in behalf of the State, so the discontinuance of the station was the only logical procedure.

#### ARTIFICIAL PROPAGATION OF FRESH-WATER MUSSELS.

The usual work in the propagation of fresh-water mussels was carried on at various points in the Mississippi Basin under the supervision of the fisheries biological station at Fairport, Iowa. By means of this work, together with well-regulated protective measures, it is expected to perpetuate the supply of commercial mussels.

During the year a total of 252,486,200 mussels in a condition of parasitism on fishes were planted in suitable waters, as compared with 331,451,490 for the preceding year. This decrease was due to very unfavorable river conditions and to an unprecedented scarcity of ripe mussels. While an abundance of female mussels with eggs was available, it was not until very late in the season that many "river muck-ets" sufficiently ripe for the work could be obtained.

Five species of commercial mussels were propagated in 1917, of which the principal ones were the common mucket and the Lake Pepin mucket. The inoculated fish hosts were liberated in the Mississippi River off Fairport and in Lake Keokuk, Iowa; in Lake Pepin, Minn.; in the Black and White Rivers in Arkansas; and in the Cumberland River in the vicinity of Kuttawa, Ky.

The actual cost of production was 2.72 cents per thousand, but if allowance is made for overhead charges the cost per thousand was 3.73 cents. In connection with this work 57,839 adult and 921,915 fingerling fish were reclaimed from landlocked ponds in the over-

flowed lands and returned to public waters. Of the number of fish rescued 110,603, or approximately 11 per cent, were infected with larval mussels. The total number of fish handled was 2,039,018.

The following table shows the details of this work:

MUSSEL PROPAGATION IN THE FISCAL YEAR 1917—POINTS OF DEPOSIT AND SPECIES OF GLOCHIDIA USED FOR INFECTION.

Species of mussel.	Cumberland River, Ky.	Arkansas.		Mississippi River.			Total.
		White River.	Black River.	Lake Keokuk, Iowa.	Lake Pepin, Minn.	Fairport, Iowa.	
Pocketbook ( <i>Lampsilis ventricosa</i> )						1,820,000	1,820,000
Mucket ( <i>Lampsilis ligamentina</i> )	4,699,000	15,432,700	34,072,500			76,805,500	131,009,700
Lake Pepin mucket ( <i>Lampsilis luteola</i> )				12,639,900	106,662,600		119,302,500
Yellow sand-shell ( <i>Lampsilis anodontoides</i> )		34,000				213,000	247,000
Butterfly ( <i>Plagiola securis</i> )		107,000					107,000
Total	4,699,000	15,573,700	34,072,500	12,639,900	106,662,600	78,838,500	252,486,200

## SURVEYS, INVESTIGATIONS, AND EXPERIMENTS.

### GENERAL ASPECTS OF THE WORK.

In biological work the year has been marked by substantial readjustments. These have arisen partly from enlarged responsibilities and opportunities coming with an increase of personnel, partly from the fact that some of the investigations have progressed to a stage justifying or requiring a rearrangement of plans, and partly from the conditions of national exigency. On the whole, the changes and the new undertakings have the effect of concentrating the efforts of the Bureau upon problems of most immediate practical importance.

The climax which came in national affairs late in the fiscal year necessitated the directing of the usual laboratory and field investigations toward increased production of aquatic supplies, especially foods, and toward measures that conduce to a reduction in wasteful and destructive practices.

### STUDIES OF MARINE FISHES.

The oceans, as the largest bodies of water, are and must always remain the greatest sources of food from fishes, and the studies intended to lay a proper foundation for the exploitation and control of marine fisheries are of very great importance. The conditions of study and the complexity of the problems are, however, of such a nature as to cause marine investigations to be relatively slow in the production of practical results. In the present circumstances, therefore, and with the lack of suitable available vessels, there has unavoidably occurred a temporary suspension of some investigations that it would have been otherwise highly desirable to continue.

The tuna investigation conducted off the coasts of southern California and Mexico has been continued throughout the year, with results which are not yet sufficiently definitive to admit of conclusions,

but which seem to indicate the delimitations of the areas of possible tuna fishery. At the close of the year plans were under consideration for a more adequate prosecution of this investigation in the hope and belief that another year would not pass without a definite and practical contribution to the solution of some of the principal problems now appearing as obstacles to a continuous and entirely successful prosecution of the tuna fishery and the industries dependent thereupon.

#### SURVEYS OF FISHING GROUNDS.

For a short period during the early winter of 1916-17 the *Grampus* was employed in surveying banks in the vicinity of Cape Fear of whose exact location, extent, and productivity the fishermen have been unaware. Unfavorable weather permitted the survey of but two grounds. The larger of these lies in 12 fathoms of water 9 miles southwest one-half south from the Cape Fear River entrance buoy, is easily found and will support an important fishery for sea bass or blackfish. The smaller ground, locally known as the "snapper bank," lies in from 12 to 13 fathoms of water  $1\frac{1}{4}$  miles west southwest from the offshore light buoy 2A at the end of Frying Pan Shoal. It is entirely surrounded by a large area of scattered patches of rock and affords good fishing when a vessel is allowed to drift over it.

The investigations of the same vessel in the Gulf of Mexico later in the winter, although seriously interrupted by storms, fog, and other circumstances, yielded information valuable to the fishery interests of Alabama, Mississippi, and Louisiana. Shrimp were taken in abundance in the otter trawl on mud bottom, in 5 fathoms of water, off the entrance to Mobile Bay. In February experimental hauls off the southeast side of Ship Island, Miss., developed a productive area at least 4 or 5 miles long on which shrimps were found in abundance equal to the best fishing off Fernandina, Fla., but with a much smaller proportion of small fish and trash. Another ground producing large shrimp in abundance was found in 9 fathoms, on mud bottom, about 9 miles southeast of Barataria Pass, La. These results indicate that a productive winter fishery for these valuable crustaceans may be developed offshore on a considerable stretch of the Gulf coast.

#### OCEANOGRAPHY.

The same causes which have contributed to a temporary diminution of activity in studies of marine fishes led before the close of the year to the interruption of some of the important oceanographic investigations.

The *Grampus* was, however, able to make a series of observations beginning with a cruise from Gloucester, Mass., to Norfolk, Va., early in the fiscal year. The vessel then made a line of hydrographic stations from Cape Henry to the Gulf Stream and thence to Cape May, N. J. Going later to Gloucester, Mass., a few stations were made in the Gulf of Maine, whence she proceeded to Southport, N. C., for investigations of fishing grounds as already mentioned, and later to Key West. In the Gulf of Mexico the vessel cruised over the continental shelf (within the 100-fathom line) from Key West, Fla., to Aransas Pass, Tex.

Some oceanographic data have also been gathered in connection with the tuna investigation on the Pacific coast.



While the field work in the investigation of Chesapeake Bay closed during September, 1916, the detailed study of materials collected, which is necessary for the drawing of conclusions, remains to be finally completed; however, substantial progress has been made.

#### SHELLFISH INVESTIGATIONS.

Provided with a more adequate personnel for attention to the problems of the oyster industry, the Bureau has been able to set these investigations upon a basis promising and already yielding greater efficiency and more practical service to the oyster industries. A provisional field laboratory has been established at Milford, Conn., from which as a base the principal problems of the great oyster-planting industry on Long Island Sound and other waters are being considered. The problem of finding the conditions necessary to secure a regular "set" of oysters is given first place, although attention is given from that headquarters to other important matters, such as the destruction or damaging of oyster beds by the growth of the so-called "sand coral."

There has been cooperation with the Conservation Commission of Maryland in observational and experimental work on the growth of oysters in Chesapeake Bay. Through the Woods Hole laboratory further attention has been given to the study of green gill in oysters of Lynnhaven Bay and other localities, and studies of some importance have been addressed to the nutrition of oysters. The results of both of these latter investigations have been given out in published reports. The Bureau has continued to extend aid to the oyster investigations of Puget Sound undertaken in cooperation with the University of Washington.

Serious mortalities among oysters or injuries to oyster beds occurred during the year in regions remote from each other and from distinct causes in the several cases. Among these was the damage to oyster beds from "sanding," owing to the work of polychæte worms in building tubes of sand and overrunning, or even smothering, the oysters; it was most prevalent in Jamaica, Great South, and Hempstead Bays. The loss of large numbers of planted oysters in Chesapeake Bay was investigated and the results were made known to persons interested. On the west coast of Florida there occurred very serious losses of oysters resulting from the depredations of a turbellarian worm, locally but improperly known as a "leach." A less misleading and more appropriate name is that of "wafer," which is applied to a similar pest in New South Wales. This form had not previously been recorded as an enemy of oysters in this country.

Mortality among scallops in Maine was investigated and found to be attributable to the work of starfishes, which were made more abundant by the pursuit of improper practices in the scallop fishery. Appropriate recommendations were made.

Investigations relating to fresh-water mussels have been continued actively. Interesting progress has been made in experiments in rearing mussels under conditions of control since it has been found that mussels (Lake Pepin muckets) reared in confinement from artificial infections begin breeding at the age of little more than two years. A second generation is now being reared from parents which

were artificially propagated and reared in confinement. Studies and experiments indicate that the natural food of fresh-water mussels is made up principally of detritus, which is decayed or decaying animal and vegetable matter, and that vegetable matter is preferred to animal. Investigations completed just at the beginning of the fiscal year have shown also that fresh-water mussels have the power of absorbing nutriment in the form of fats (olive oil) and protein (egg albumen) directly from solution in the water and through the cells of the surface of the body (gills, mouth, palps, and foot). It was possible to determine that the fats, so taken up by the cells of the outer body walls, were transported through the circulatory system to the various parts of the body.

Considerable attention has been given to the matter of securing for the mussels proper protective legislation on the part of the several States. Under present conditions, the efforts of the Bureau to propagate fresh-water mussels are not supplemented as they should be by the extension of a reasonable measure of protection to the young mussels.

A study of the causes of pearl formation in fresh-water mussels has been brought to a stage of reporting. There has also been obtained during the year a valuable fund of information regarding the pearl fisheries and pearl culture in the Far East to which it is hoped to give publication within a reasonable time.

#### BIOLOGY OF THE BLUE CRAB.

A new investigation of the life history and habits of the blue crab, although begun only at the beginning of the fiscal year, has already made such progress as to supply the information most needed as a basis for the regulation of the fishery and the conservation of the blue crab, particularly in Chesapeake Bay, the headquarters of the world's greatest crab fishery.

The blue crab may spawn more than once. Crabs under observation have spawned twice in the same summer. The female crabs which are dredged during the winter are prospective spawners whether or not they have spawned during the preceding season. The life history of this species in Chesapeake Bay is, in brief, as follows:

Nearly all the young are hatched in the lower bay from the last of June to about the first of September. The great majority of the young begin a migration northward up the bay, settling on the bottom when cold weather comes and ceasing to feed or to shed. The next spring they resume development and their northerly migration. They reach maturity in Maryland waters, where mating occurs, principally during the last of July and August. Mating occurs only once during the lifetime of the female, but sufficient sperm is received and carried to fertilize two or more successive batches of eggs. The females then migrate southward to the lower part of the bay, while the males generally stay behind, spending the winter in deep water or in creeks and rivers. About 80 per cent of the adult crabs taken in the upper waters of the bay are males, and, correspondingly, about 80 per cent of the adult crabs taken in the waters near the mouth of the bay are females.

Some of the females lay a batch of eggs before or while going south, but probably the greater number lay no eggs until the following season. A certain small percentage of the young do not migrate up the bay but remain to develop and mate in the lower waters.

At the approach of cold weather the crabs settle to the bottom and are usually supposed to bury there, but it is probable that they simply lie dormant and occasionally move slowly over the bottom. Practically all females dredged during the winter, whether or not they had spawned previously, were found to contain eggs and the live sperm with which to fertilize them. There is no evident northward migration of such crabs in the spring. Most of the females die shortly after the last batch of eggs is laid. Crabs mature in about a year, growing in size by successive moltings. Mating occurs only at the last molt of the female, when the abdomen changes from the triangular to the apron form. The length of life is apparently two or three years.

An investigation of the spiny lobster, an important crustacean and excellent article of food in the waters of southern Florida, was undertaken about the middle of the fiscal year, and satisfactory progress is being made.

#### PROGRESS IN CULTURE OF DIAMOND-BACK TERRAPIN.

The results of the continued experiments in diamond-back terrapin culture at the Beaufort (N. C.) laboratory were given at some length in the last annual report. The progress during the past year has been gratifying, especially in the rapid growth of the young terrapin hatched in the summer of 1916. The largest individual kept in a warm house and fed during the winter was more than three inches (80 mm.) in length of bottom shell. This is believed to be a new record for the growth of diamond-back terrapin in the first year of life, and gives further encouragement to terrapin culture as a commercial enterprise.

#### STUDIES OF ANADROMOUS FISHES.

At the beginning of the fiscal year, two particularly important investigations were in progress relating to fishes which, though not alike in structure or appearance, have the same interesting and significant habit of leaving the ocean and ascending streams for the purpose of giving rise to a new generation. This habit is of particular practical importance because essentially all the mature individuals of the species are periodically assembled in definite runs in restricted localities, when they are easy of capture on the one hand and available for purposes of artificial propagation on the other. It is most desirable that there should be available specific and reasonably complete knowledge of the migrations of the shads and the salmons and of the conditions to be met in protective measures and in practices of artificial propagation.

Progress was made in the analyses of the data accumulated during the field studies on the principal shad streams from St. Johns River, Fla., to the St. Croix River, Me., and New Brunswick, but probably no stage of completion can be reported until, with a change of conditions, it becomes again possible to give the careful attention to the elaborate measurements, comparisons, and analyses which the subject requires.

A further investigation of the migrations of the Pacific salmon has been undertaken with the most competent assistance, having special reference to the salmon of Alaska and the problems of governmental and private artificial propagation.

#### INVESTIGATIONS PERTAINING TO FRESH-WATER FISHES.

The Bureau has continued actively the several investigations relating to the food of fresh-water fishes, both as independent studies and as phases of the experiments in the rearing of fishes in ponds. The results of more than two years of study of the habits and food of the yellow perch have been prepared for publication. A report on the pikes, comprising most of the known data regarding the habits, artificial propagation, and commercial importance of this well-defined family of fishes, has been issued and will prove useful to those who are interested in the cultivation of the pike, pickerel, and muskellunge, and to whom it is of importance to understand the relations of these predatory fishes with their less vigorous associates in natural or artificial bodies of water.

The serious decline in important fisheries of the Great Lakes, due to excessive and sometimes unrestricted fishing, long ago showed the necessity for a thorough knowledge of the habits and migrations of the principal fishes of the Lakes, in order that the regulation of the fishery and the artificial propagation of the fishes might be founded upon such a clear understanding of the habits and movements of the fishes that the maximum in practical results would be attained. It has not yet been possible to give to this field attention commensurate with the importance of the fisheries and the difficulties of the problems. A beginning was made during the fiscal year in the inauguration of a new study of the systematic relations, habits, and migrations of the fishes of the subfamily Coregoninæ, including the whitefishes and ciscoes or lake herring.

The experiments and investigations in the rearing of fishes in ponds, which have been pursued in connection with the fisheries biological station at Fairport, Iowa, have continued to yield gratifying results. While the artificial propagation of the buffalofish had previously been shown to be entirely feasible as regards the fertilization and subsequent handling of eggs and the rearing of young to a fairly advanced stage, the effort to have buffalofish spawn naturally in artificial ponds had not, until the spring of 1917, met with success. The conditions were varied last season by keeping the experimental pond about half full of water in the early part of the season and allowing it to fill gradually early in May. A few days after the pond was filled, a few buffalofish were observed to be "splashing" along the margin of the pond. Abundant buffalofish fry were observed soon afterwards, when specimens were collected and identified. Without additional experimentation it can not be definitely determined if the manner of manipulation of the pond practiced this season was the particular effective factor in bringing success.

In the last annual report it was mentioned that, in spite of many failures in earlier trials, a successful attempt at the propagation of the channel catfish, or spotted catfish, in ponds was in progress as the fiscal year closed. As the channel catfish at Fairport have again spawned under observation in the ponds of Fairport, it seems alto-

gether probable that this most highly esteemed of all catfishes can be propagated successfully in a practical way, by providing a suitable environment and proper nesting conditions, and by the exercise of care to separate the adults from the eggs or young at the proper time. The fry which hatched in the ponds and those which were hatched from eggs in jars in the experimental battery grew rapidly, attaining a length of 3 inches in a few weeks.

Other experiments in the propagation and rearing of the largemouth bass and several species of sunfishes have also been in progress.

In experiments in the rearing of fishes attention has been given to the study of the food of the developing fishes at all stages, and to collateral observations of the available food supply. Experiments have also been undertaken in the artificial feeding of fishes in ponds.

During the fiscal year a careful biological and fish-cultural survey of certain waters of western North Carolina, including the Mount Pisgah National Forest Reserve, was made and information was gained that will be of material value in guiding the Government's activities in the propagation and protection of fishes in the reservation.

The fish capacity of artificial ponds or of natural lakes is determined by physical, chemical, and biological conditions, and success in the rearing of fishes or the conservation of fishes will be greater if guided by a proper knowledge of these interrelated conditions. The subject is one of much complexity and knowledge grows only by slow stages and patient application. The Bureau has been glad, therefore, to continue its cooperation with the State Geological and Natural History Survey of Wisconsin, in those fruitful studies of the biological and physical conditions in Wisconsin lakes which have a general application.

In the study of the fishes in relation to the extermination of mosquitoes and to public health, as supplemental to the broader investigations and activities of the Public Health Service and the Bureau of Entomology, a satisfactory degree of progress has been made and further experiments are undertaken in promoting a growth of desirable species of fish in impounded waters.

#### WATER-POWER DEVELOPMENT IN RELATION TO FISH LIFE.

With progress in water-power developments and a steady increase in the number of dams in the course of rivers frequented by migratory fishes, it is unfortunate that there is not more adequate information as to the conditions under which fishways are necessary and practicable and the types of fishways adapted for particular species of fish and conditions of stream and dam environment. As much attention as possible has been given to the matter during the fiscal year and a report on the subject was issued. Plans are in contemplation for more extended field studies during the fiscal year 1918.

The peculiar problems of fish protection in arid regions arise from the fact that large portions of the flow of streams may be diverted into irrigation canals, and, if the fish are permitted to pass freely through the canals and into the laterals, they must eventually be stranded in the fields or otherwise lost. An investigation of the conditions in irrigation projects was begun last winter, and a preliminary report on the subject has been made. The investigation has been interrupted for a time by the pressure of other matters.

At the Yuma (Ariz.) project the fish are excluded from the canals, because of an arrangement whereby the water enters the canals from a settling pool through a siphon that is fish tight. Seven miles below Yuma the maintenance of a dam on the Colorado River for diversion of water in Imperial Valley, Cal., causes the river bed below the dam to be left dry at times so that quantities of fish are stranded. The Salt River project involves a large system, but as the canals and ditches always contain water there is little reason to suppose that much damage to fish occurs. The reservoir formed by the construction of the Roosevelt Dam in Arizona has been well stocked with bass. Fish are reported to be lost in the spring freshets, when the water rises to a height of 10 feet or more above the top of the spillways, carrying fish over the dam and through a fall of 225 feet. The prevention of such losses by the use of screens to hold the fish back has been given consideration, but the difficulties are very great and possibly insurmountable.

In California, and especially in the Sacramento River basin, where large areas of land are farmed by irrigation, large losses of fish would occur but for the effective work of the State authorities in requiring all ditches and intakes to be provided with screens and all dams with fishways. A recent act of the legislature requires the owners of dams that are too high for a useful fish ladder to build and maintain hatcheries. In that State the "squirrel-cage" type of revolving screen is generally recommended for its simple design and cheapness of construction, but for canals wider than 25 or 30 feet the parallel-bar type of screen is considered the only practical means of keeping fish out. In Nevada a new law effective September, 1917, requires the screening of intakes and ditches as well as the use of fishways. Irrigation is extensively practiced in the northern half of the State, and heretofore countless numbers of trout fry and other fishes have been poured into the fields.

#### SERVICE OF THE BIOLOGICAL LABORATORIES.

The various investigations in progress at the several biological laboratories at the close of the preceding fiscal year were continued during the early part of the present year. Before the close of the year, however, it was found desirable to adopt temporarily a new policy with regard to the laboratories because of the necessity of concentrating all efforts, as far as possible, upon the immediate increase of the aquatic food supply.

The laboratory at Woods Hole was not opened for general investigations but a special staff was stationed at that laboratory for work relating to the improvement of methods of preserving fish. One investigator was employed for observation of the occurrence of nematode parasites in the flesh of marine fishes, a question which has been found to have a direct bearing upon the marketing of fish.

At the Beaufort laboratory the scientific staff consisted only of the director and one investigator who was enabled to continue the important and timely investigation of the protection of wood against marine borers. The director devoted himself to experiments in the curing of fish by methods of salting and of salting and smoking. It had been generally believed that the curing of local fishes during the summer was not practicable, but, largely as a result of the Bureau's

efforts and experiments, several kinds of fishes have been preserved and the dealers have found a good demand for salted fish.

The fish-cultural experiment work of the fisheries biological station at Fairport bears so directly upon the immediate problems of food supply that the activities of this station have suffered no curtailment, but are expected to be somewhat extended during the ensuing year. Among the investigations in progress, apart from the direct experiments in rearing fishes as previously referred to, are those relating to insects and insect larvæ, aquatic plants, and parasites, as they affect the productivity of ponds or lakes. The results so far obtained are already valuable in guiding the management of fishponds.

The construction of the marine biological station at Key West was undertaken during the fiscal year. The pool which will serve as a source of supply for sea water, for the protection of small boats, and for other purposes, has been excavated, and a canal connecting the pool with the ocean has been completed except for a control gate. Plans for two of the buildings were completed and bids were advertised for in the last month of the year. Owing to various causes, including the present high prices of labor and materials, there exists some doubt if a reasonable bid will be received. Meantime, some scientific work was begun during the winter and encouraging progress has been made. The study of the spiny lobster has been the principal investigation.

#### MISCELLANEOUS INVESTIGATIONS AND SERVICES.

There has been an unusual number of calls upon the Bureau for investigations and advice relating to the diseases of fishes or to the mortality of fishes in public or private waters, due either to disease or to industrial pollutions. In as many cases as possible the fish pathologist of the Bureau, or an assistant, has visited the scene of trouble, made all practicable observations or collections, and upon return to the office has subjected the material and data to careful examination. The most serious trouble of this kind to arise was a mortality of sea fishes on the west coast of Florida, which has been described and discussed in a published report.<sup>a</sup> Other serious troubles manifested themselves in Chesapeake Bay, Saginaw River and Bay, and elsewhere.

The Bureau has not only continued to cooperate with the Bureau of Soils, as far as the conditions permitted, in a study of kelp harvesting in relation to the fisheries, but it has begun a systematic study of the distribution of marine algæ on the west coast with particular attention to species that may be useful in the industries.

#### ALASKA FISHERIES SERVICE.

##### IMPORTANCE OF THE ALASKA FISHERIES.

All branches of the fishing industry, except whaling and halibut fishing, showed an increase in 1916 over 1915, and the fisheries in the aggregate were more extensive and valuable than ever before. The number

<sup>a</sup> Mortality of Fishes on the West Coast of Florida. Appendix III, Report of Commissioner, 1917; by H. F. Taylor. Bureau of Fisheries document No. 848.

of persons engaged was 23,994, an increase of 1,532 over the previous year; the investment amounted to \$39,569,612, an increase of more than \$2,253,000; and the value of the products was \$26,156,559, an increase of more than \$5,157,000. The yield of the fisheries in both quantity and value was the largest in the history of Alaska. The record year, 1914, was surpassed by nearly \$5,000,000 in the market value of the output.

The salmon industry in 1916 represented 88 per cent of the total investment in Alaska fisheries and 92 per cent of the total value of products. An important feature of the business was the operation of 100 canneries, a gain of 15 over 1915. The pack of canned fish reached the stupendous total of 4,900,627 cases, valued at \$23,269,429, which figures were never before equaled. In southeast Alaska, the runs of coho and chum salmons were the largest ever known, and the runs of humpback and red salmons were exceeded only by the seasons of 1915 and 1914, respectively. In central Alaska there were exceedingly heavy runs of humpbacks and reds, and the fish canned exceeded by 400,000 cases the high record of 1914. In western Alaska, the district in which the red salmon predominates, the catch of 19,600,000 fish was but little less than the average for the five-year period ending with 1916 and was about 3,000,000 fish more than in 1915.

The other important Alaska fisheries in 1916 had the following value of products: Halibut \$679,463, cod \$518,797, herring \$418,076, and whale \$363,721. As compared with 1915, the halibut and whale fisheries showed a decline and the cod and herring fisheries an advance,

#### VIOLETIONS OF THE FISHERY LAWS.

Taking into consideration the immense extent of the fisheries, the vast territory covered by the operations, the comparatively unsettled condition of most of the coastal sections, and the strong temptations that come to the fishermen to take fish regardless of the welfare of the industry, serious violations of the fishery laws are remarkably infrequent.

During the 1916 fishing season a number of cases of minor infraction of the laws were reported by the Bureau's agents to the local United States commissioners and district attorneys. These cases involved fishing during the weekly close period, fishing in prohibited areas, and using nets within illegal distance of other nets. In most instances conviction was secured and a fine was imposed. A noteworthy batch of cases was brought before the United States commissioner at Haines in August, 1916. The Bureau's warden made complaint against the operators of 3 boats and 28 operators of nets, found fishing in Chilkoot River and Chilkoot Lake in violation of the weekly close-time provision of law. All of the defendants pleaded guilty and were fined from \$1 to \$250 and costs.

#### CENSUS OF WOOD RIVER SALMON.

Wood River, a tributary of Nushagak Bay, has for many years been set aside as a natural breeding preserve for salmon, chiefly resorted to by the red salmon. In order to keep informed as to the extent to which the salmon are able to escape the commercial fishing operations in Nushagak Bay and pass up Wood River to their spawn-



ing grounds about Lake Aleknagik the Bureau in 1908 began the enumeration of the fish and has continued this work each year since, 1914 excepted. By means of a temporary rack thrown across the stream near the lake, the fish are compelled to pass through a narrow gate and are there counted by agents kept continuously on duty, by day and night, for about seven weeks during which time the run lasts.

In 1916, between June 23 and August 12, the number of salmon ascertained to have gone to their spawning grounds was 551,959, compared with 259,341 in 1915. The bulk of the fish came in three distinct waves in July, at the crest of which 57,237, 47,343, and 55,864 salmons, respectively, were noted in 24 hours. Except during the heavy runs a considerable proportion of the fish showed injuries attributable to nets, and such fish were somewhat more numerous than in 1915.

Acknowledgments are due to several fishing companies for assistance which made this work possible. The Alaska-Portland Packers' Association provided a tug for towing the equipment to the lake. The Alaska Salmon Co. supplied a boat for use in making investigations on the lake and the Alaska Packers Association furnished the entire equipment required for making the count.

#### A FISHERY INTELLIGENCE SERVICE FOR ALASKA.

In response to a formal request by the Territorial Legislature of Alaska, the Bureau of Fisheries in conjunction with the Signal Corps of the United States Army established (in the summer of 1917) a fishery intelligence service whereby a number of coastal towns in Alaska are furnished daily (Sundays and holidays excepted) with the prices of fishery products at Seattle and Ketchikan. The daily quotations include the prices of the more important kinds of fresh fish, and on Monday of each week additional information is furnished in regard to prices of salt products at Seattle and Ketchikan. It is hoped that the service thus afforded the public will tend to stabilize prices and to create a more dependable market for the fishermen's products.

#### COMMERCIAL FISHING WITHIN THE ALEUTIAN ISLANDS RESERVATION.

During the past fiscal year 11 permits to engage in fishery operations within the Aleutian Islands Reservation were issued to the following persons and companies:

1. S. Applegate, of Berkeley, Cal., authorizing the packing of not to exceed 300 barrels of salmon per annum in the vicinity of Umnak Island.

2. A. C. Goss, of Unalaska, authorizing the taking of atka mackerel and red salmon in the vicinity of Attu Island and Umnak Island, respectively, in 1917.

3. Pacific American Fisheries, authorizing the construction and operation of a plant on Ikatan Peninsula for the canning or salting of salmon or other food fishes.

4. Sockeye Salmon Co., authorizing the construction and operation of a plant on Unimak Island for the canning or salting of salmon or other food fishes.

5. Paul Buckley, of Unalaska, authorizing him to engage in cod fishing operations on Akutan Island.

6. Paul Buckley, authorizing him to engage in cod fishing operations on Unalaska Island.

7. Alaska Fishing Co., authorizing the taking of not to exceed 1,000 barrels of salmon in the vicinity of Unalaska Island in 1917.

8. Paul Buckley, authorizing him to construct and operate on Unalaska Island a plant for the canning or salting of salmon and other food fishes taken in the vicinity of Unalaska Island.

9. O. K. Quean, of Unalaska, authorizing him to take not to exceed 200 barrels of salmon in the vicinity of Unalaska Island in 1917.

10. Alaska Commercial Co., authorizing the packing at Unalaska of not to exceed 50 barrels of salmon in 1917.

11. Andrew C. Smith, of Portland, Oreg., authorizing him to engage in the business of salting cod and salmon for commercial purposes at Chernofski Harbor and Kuliliak Bay.

All of these permits stipulate that employment shall be given as far as practicable to natives of the reservation in the matter of carrying on the operations authorized. All permits are revocable at the pleasure of the Secretary of Commerce.

Two permits authorizing operations within the Aleutian Islands Reservation have been issued jointly by the Departments of Commerce and of Agriculture. One involves the pasturing of cattle, sheep, and other domestic animals by Paul Buckley upon that part of Unalaska Island which is south and west of Kashega and Kuliliak Bays; the other somewhat similar operations on Unimak Island by Andrew C. Smith.

#### INSPECTION OF PRIVATE HATCHERIES.

In the year 1916-17 there were operated in Alaska four salmon hatcheries belonging to companies engaged in the catching and canning of salmon. These obtained 90,136,000 eggs of the red salmon, and hatched therefrom 83,353,000 fry which were planted in local waters. Under the law the rebates of taxes allowed these companies, amounting to 40 cents for each 1,000 red or king salmon fry released, aggregated \$33,341.

#### STREAM IMPROVEMENT.

An important matter in the conservation and increase of the salmon supply in Alaska is the improvement and development of additional natural spawning beds. There are numbers of streams in Alaska, particularly in the southeastern section, which are impassable to salmon because of natural barriers, chiefly waterfalls. In some cases, also, streams have become choked through the accumulation of timber and other débris. It is felt that much good may be accomplished by giving the salmon every possible opportunity to spawn naturally. There are various places where falls can be blasted out or where fishways can be established, thus opening up a considerable extent of spawning area which heretofore has been wholly inaccessible to salmon or which in some instances has been accessible only at periods of high water. The Bureau feels that at comparatively small expense excellent work can be done in bettering

these conditions. A few streams were improved in this way during the past year, but the work has been limited because of a lack of funds. It is hoped that these operations can be undertaken on a more extensive scale in the near future.

### ALASKA FUR-SEAL SERVICE.

#### SEAL ISLAND NATIVES.

The welfare of the native inhabitants of the Pribilof Islands is a matter demanding and receiving the constant solicitude of the Bureau. The attitude of Congress toward these people, as shown by the safeguards thrown around them and funds provided for them, has resulted in the gradual development of a community that is probably better cared for than any other natives of Alaska.

On June 30, 1916, the resident natives numbered 311 (192 on St. Paul and 119 on St. George Island), and on March 31, 1917, they numbered 316 (193 on St. Paul and 123 on St. George). The population remains nearly stationary, the fluctuations in recent years not exceeding 2 or 3 per cent. The general health of the natives has continued good. The physicians and the school-teachers, acting under the immediate direction of the agents, deserve much credit for their work in improving sanitary conditions among the natives and for their efforts to raise the standard of living.

A full account of the measures taken for the support of the natives, their education, and their physical care is given in the report on the Alaska service for the calendar year 1916.

The act making appropriations for the Bureau for the fiscal year 1917 contained an item of \$20,000 for new buildings, repairs to old buildings, and other necessary improvements on the Pribilof Islands. The appropriation became available too late to permit the purchase and transportation of materials in the season of 1916. Accordingly, the work of planning for the most important constructions and repairs was taken up in the winter of 1916-17, and a large quantity of building material was sent to the islands in July, 1917, on the steamer *Roosevelt*. The matters to which special attention has been given during the present season, in addition to general repairs to existing structures, are (1) the construction of new houses for natives on both islands, (2) the construction of a new salt house on each island for use in preserving and storing sealskins, (3) the installation of a new water-supply system for the village on St. George Island, (4) a survey for a new water-supply system for the village on St. Paul Island, and (5) important sanitary improvements on St. Paul Island.

Careful consideration has been given to the type of house that would be most suitable for natives. The houses now occupied were built for the most part 40 years ago, and are small, uncomfortable, and insanitary. Final choice has been made of a neat, simple knock-down house, plans for which were submitted by a Seattle firm, comprising a living room, three bedrooms with closets, a kitchen, and a bathroom, all on one floor. Four such houses for St. Paul Island and two for St. George Island have thus far been provided.

The large quantities of supplies annually required for the support and use of the natives, and of the Government employees on the

islands, together with the materials needed in connection with the taking, curing, storing, and shipping of seal and fox skins, were, for the season of 1917, sent to the islands on the steamer *Roosevelt*. This is the first time that the Bureau has been able to employ its own vessel for this service.

#### APPROPRIATIONS FOR SEAL SERVICE.

Owing to the increased cost of supplies it became necessary to devote a larger part than heretofore of the appropriation of \$75,000 for the fiscal year 1917 to the Pribilof Islands. During the second half of the fiscal year the Bureau was forced to limit greatly or altogether suspend certain activities of the work pertaining to the protection of the fisheries and the minor fur-bearing animals. Congress has made the same appropriation, namely, \$75,000, for the entire Alaska service for the fiscal year 1918. In the season of 1917 there was a still further increase in the cost of supplies, as was evidenced by the return of proposals submitted in May, when the aggregate amount was found to be approximately \$72,000. Steps were, therefore, taken to secure a supplementary appropriation. Inasmuch as the Bureau is charged with the support of the natives on the Pribilof Islands, it feels that its first duty is to purchase the needed supplies for that purpose. Unless Congress meets this emergency, the work of the Alaska service in regard to the protection of the fur-bearing animals and fisheries must perforce be so curtailed and limited as to be seriously ineffective.<sup>a</sup>

#### CONDITION OF THE SEAL HERD.

A detailed statement of the condition of the Alaskan seal herd in 1916, with various tables and comparisons with former years, is contained in the report entitled, "Alaska Fisheries and Fur Industries in 1916," published in August, 1917 (Bureau of Fisheries document No. 838, 118 pages). The usual complete census, conducted by G. Dallas Hanna of the Bureau's staff, showed 417,281 seals of all ages in the herd in the summer of 1916, an increase of 14.6 per cent over 1915. Tentative figures of the census of 1917, also under the direction of Mr. Hanna, indicated a total of 468,692 animals of all ages. The estimated number of pups born in the summer of 1917 was 128,024, as against 116,977 in 1916.

These increases in the seal herd resorting to the Pribilof Islands are regarded as entirely satisfactory and such as are to be regularly depended on so long as the present conditions prevail. The recuperation of the herd to something like its former proportions within a comparatively few years may confidently be expected. The natural mortality among the various classes is now normal; and the only untoward feature of the present situation is that arising from the great preponderance of mature and adolescent male seals as a result of the close-time that has been effective for five years and expired on August 24, 1917. It should be the consistent policy of the Bureau, as it is its obvious duty, in the light of the established biological facts and economic demands, to so administer the seal herd as to overcome the existing disparity of male life and to ultimately bring the herd to a condition approaching that of a scientifically managed herd

<sup>a</sup> Congress has since appropriated an additional sum of \$35,000 for the Alaska service for the fiscal year 1918.

of dairy cattle, where every young female born will be saved and reared and every young male not actually required for breeding purposes will be otherwise utilized in the most profitable manner.

#### SEALS REQUIRED BY SEAL ISLAND NATIVES.

The quota of seals whose meat was needed for food by the natives of the Pribilof Islands was tentatively fixed at 7,500 for the calendar year 1916. The number actually taken and utilized, including the few seals which died during the drives, was 6,468, of which 3,483 were from St. Paul Island and 2,985 from St. George Island.

For the calendar year 1917, which up to and including August 24 was subject to the close-time law fixed by Congress, the food requirements of the natives were regarded as the same as in 1916, although it was of course contemplated that a part of those requirements would be met by the seals taken for commercial purposes.

#### SALE OF SEALSKINS.

During the fiscal year 1917 there were three public-auction sales of skins taken from the seals that had been killed for the use of the natives. These sales were conducted at St. Louis by Messrs. Funsten Bros. & Co., agents of the Department, and consisted of skins that had been received during several years, there having been no attempt to dispose of sealskins in the fiscal year 1916 owing to the condition of the market. The details of the sales are as follows:

Date.	Skins.	Gross prices received.	Net prices received.	Average gross price per skin.
	<i>Number.</i>			
September 20, 1916.....	1,900	\$74,530.00	\$52,083.26	\$39.23
January 29, 1917.....	2,000	93,678.00	65,450.27	46.84
April 18, 1917.....	1,500	68,540.50	48,259.65	45.69
Total.....	5,400	236,748.50	165,793.18	43.84

All of the foregoing skins were dressed, dyed, and machined before being offered for sale, and were thus ready to be made into garments. This is the newest feature of the sealskin industry as established in America by the Department. The financial results have been such as to fully justify the agreement whereby the Government paid \$10 apiece for the skins thus treated, and the buyers have expressed great satisfaction that they were able to obtain finished goods, whereas under the conditions formerly prevailing they would have been obliged to undergo the delay, the uncertainty, and the greatly increased expense of having their raw skins shipped to London and reshipped to America before any use could be made of them. It is impossible to state just what monetary benefit the Government has derived from this arrangement, but some data afforded by the April sale were very suggestive. On that occasion there were sold at public auction, under the same conditions that attended the sale of 1,500 dyed and dressed Alaskan skins, 1,553 raw skins taken from the Robben Island seals under the supervision of the Japanese

Government; the Japanese skins were of essentially the same quality as the Alaskan, and whereas the former brought on an average \$25.84 per skin, the latter, as already stated, brought \$45.69 per skin, an increase of \$19.85 after allowing for the cost of preparation.

All branches of the fur-seal industry have thus become firmly established in America through the action of the Department, and not only Alaskan skins but skins from seal herds in the custody of other governments are finding their markets here.

#### BRANDED SEALS.

The 5,228 fur-seal pups branded on the Pribilof Islands in 1912 have continued to afford valuable data bearing on the relation of age to size and growth. These data supply the most authentic and only conclusive evidence on this much-discussed subject.

During the season of 1916 numbers of these branded seals—both male and female—were observed in drives and on the rookeries. On St. George Island, in the period from June 9 to August 10, 1916, there were noted in various drives 198 male seals bearing the 1912 brand and therefore 4 years old; 30 of these were taken for accurate measurement. Branded seals were noted in nearly every drive of bachelors and in considerable numbers among the cows in the harems. On St. Paul Island 44 branded males were taken for examination. The foregoing examples were included in the 1916 shipment of skins and were classified by the experts in St. Louis as follows, the designation being in accordance with the long-established and universally recognized London standard:

	Number.
Small pup.....	2
Middling pup.....	4
Large pup.....	22
Small.....	27
Middling.....	4
Middling and small.....	15
Total.....	74

The variations in the size of seals of the same age are clearly shown in this statement. The 74 skins from seals known to be 4 years old fall into six trade categories, with "large pups" and "small" predominating. The trade names applied to sealskins have come to mean so little and are so misleading that a new classification would seem to be demanded.

#### UTILIZATION OF WASTE PRODUCTS OF THE SEALING INDUSTRY.

With the exception of limited quantities of seal meat required by the native inhabitants of the Pribilof Islands, practically the entire carcass of the fur seal after the removal of the skin has up to this time been discarded. During the close time, with its restricted take of seals, this waste of useful material has not been serious, but with the resumption of commercial sealing it will become the duty of the Bureau to endeavor to find a practicable way of utilizing the seal carcasses and of thus making the fur-seal service still more of a revenue producer to the Government. The difficulties connected

with the profitable exploitation of this waste material are the cost of transportation, the absence of harbors, and the uncertainty attending the landing and loading of equipment and products. To this matter, to which considerable attention has already been given, the Bureau will devote still further effort looking to the conduct of the work either by private firms under contract or by governmental agency.

A valuable legacy of the old times, when 5,000,000 pounds of seal carcasses were frequently allowed to rot on the killing grounds in a single year, is the accumulation of bones. No use was ever made of this important fertilizer, and it has remained for the past year to record the first attempt to secure the commercial utilization of seal bones.

The Bureau has conducted considerable preliminary work to determine the extent and value of the seal-bone accumulations, and has interested numerous individuals and firms in the matter. In the summer of 1916 a considerable quantity of bones was collected and sent down on the supply ship; and samples of this shipment in lots of 50 to 300 pounds were, on request, sent to various persons for examination. An analysis made by the Bureau of Soils, Department of Agriculture, showed that these bones, some of the samples of which were from seals killed many years ago, have valuable fertilizing properties, containing from 24.85 to 25.26 per cent of phosphoric acid and from 4.57 to 4.80 per cent of nitrogen. A report received from the islands indicated that the bone deposits actually in sight represent about 6,000 tons, with a number of killing grounds not included; and it has become apparent that, notwithstanding the skepticism and scoffing of certain persons who had formerly been on the islands, there exists in these bones a valuable resource which should be put on the market, especially at this time when the supply of fertilizers has been reduced by the war.

Some of the bones, resulting from the most recent killings, are on the surface, but most of them have become overgrown with grass and are covered with earth and sand. During the past year the natives have been employed, at such time as their other labors would permit, in collecting bones. Owing to the frozen state of the ground, the work of gathering bones is mostly confined to the period from May to November. This coincides with the active sealing season when every able-bodied native must devote considerable time, and some of them all the time, to sealing operations, the landing of supplies, the shipment of skins, and occasionally to important construction work. For these reasons the quantity of bones that would otherwise have been available in the season of 1917 was curtailed, but nevertheless several hundred tons were gotten ready and will be shipped as opportunity is offered. The poor roads on the islands hinder the transportation of bones from the deposits to the villages, but the situation is being improved, and a light motor-truck equipment is being provided to facilitate this work. Bone crushers have been sent to the islands so that bones may be ground and thus be put in compact form to save space in transportation.

After considerable correspondence and negotiation with various persons and companies in regard to the utilization of the bone deposits on the Pribilof Islands, the Bureau early in July, 1917, accepted an offer made by a Seattle firm to pay \$30 per ton for 300 tons or less

delivered f. o. b. vessel at dock in Seattle. A similar offer may be expected for all the bones that may be obtainable in the next few years.

Arrangements are being made so that all other by-products resulting from the taking of fur-seal skins will be utilized. It is expected that use can be made of all seal gullets, which have been found to be convertible into a good grade of light leather suitable for special purposes. Experiments are now under way to use the intestines for casings. The blubber is being saved for use in dressing the skins. A small canning outfit was sent to the islands in the summer of 1917 with a view to determining the feasibility of canning seal meat, of which a quantity far in excess of the natives' needs will hereafter be available. A considerable quantity of the waste products resulting from sealing operations will be required for feeding the fox herd on St. George Island, where the supply of natural food during the winter is very limited.

Careful consideration is now being given the plan of installing a small plant at the Pribilof Islands for the purpose of preparing oil and fertilizer or other products from the excess refuse material resulting from the seal killings. This matter will be definitely worked out before another season, so that there will be no loss of any part of the seal products. This is a distinct advance over conditions which existed at the Pribilof Islands when commercial killing was in progress years ago, for at that time there was no effort to make use of any part of the seal except its pelt.

In anticipation of large sealing operations and the necessity of employing the best methods in taking, curing, and caring for the skins of fur seals, and also of blue foxes, an arrangement was made with Messrs. Funsten Bros. & Co. whereby there were sent to the islands in the season of 1917 two experienced seal men from Newfoundland and two expert sealskin handlers from St. Louis. These men are to cooperate with the agents, instruct the natives, and bring into closer relation than heretofore the seal fishery and the sealskin trade.

#### BLUE FOXES AND REINDEER ON THE PRIBILOF ISLANDS.

In September, 1916, the skins of blue and white foxes that had been taken on the Pribilof Islands in the preceding winter were sold at public auction in St. Louis. The extraordinary prices received for blue-fox skins in the 1915 sale were not obtained in 1916. The best lots brought \$113, \$125, \$128, and \$135 per skin, the average for the entire collection of 420 being \$48.20. The 20 white-fox skins brought \$14.25 each. The gross receipts from this sale were \$20,527.

During the winter of 1916-17 the foxes on St. George Island were found to be unusually numerous, and there was a noteworthy increase in the number of pelts obtained. The take of 417 blue-fox skins and 2 white-fox skins left an ample reserve, 413 foxes having been marked and released, while many unmarked animals were known to be on the island at the end of the trapping season. The pelts obtained on St. Paul Island numbered 150 blues and 37 whites. These skins, numbering 606, were sent to Seattle on the steamer *Roosevelt* in August, 1917.



In compliance with a request from the Bureau of Biological Survey, Department of Agriculture, there were furnished from the Pribilof Islands six pairs of blue foxes for an experimental fox farm located in New York. The foxes were captured on St. George Island, taken to Seattle on the supply steamer, and delivered to an agent of the Department of Agriculture; two of the animals died en route.

From the small number of reindeer placed on the seal islands in 1911, there has grown a herd which in August, 1916, numbered about 196 animals of all ages. A few of the males have been appropriated for the food purposes of the natives, and plans have been made for increasing the usefulness of the reindeer to the natives.

#### VESSEL FOR THE PRIBILOF ISLANDS.

St. Paul and St. George Islands, which are the two important islands of the Pribilof group, are approximately 40 miles apart. At present there is no safe means of getting from one island to the other except upon the infrequent occasions when a Coast Guard cutter happens to be in the vicinity or the Bureau's supply steamer *Roosevelt* is making a regular trip. These islands are practically in the center of Bering Sea and are exposed to heavy storms, hence the small launches now in use are altogether unsuited and unsafe for this journey between the islands. It is therefore felt that a staunch vessel at least 75 feet in length and about 18 feet in breadth, and powered with an internal-combustion engine of at least 125 horsepower, should be secured for use at the islands. This vessel should be of the type which has been developed as the most satisfactory form of cannery tender for use in the exposed waters of Alaska, capable of riding out a gale when necessary.

A tender of this character for the islands is very much needed for the transportation of persons, especially at the time when the important work of the fur-seal census is in progress, and it is also needed for the transportation of supplies from one island to the other. It is required for occasional trips to Unalaska, the nearest town, 250 miles distant. With the resumption of commercial sealing operations next season, such a vessel will be very valuable in handling the increased take of fur-seal skins and other products, particularly in the matter of lightering cargo to the ship, which must anchor some distance offshore. A tender of this type may also be very important for use at times as an auxiliary in guarding the fur-seal herds.

It is therefore recommended that Congress be asked to authorize the construction or purchase of a vessel of this character for the purposes stated, and an item to this end has been inserted in the estimates of appropriations for 1919.

#### SEALSKINS TAKEN BY ABORIGINES.

Under certain restrictions Indians, Aleuts, and other aborigines dwelling on the Pacific coast of North America north of the thirtieth parallel of north latitude may hunt fur seals. Primitive methods of capturing seals are enjoined by law and treaty and the

annual take of skins by the aborigines residing in the United States is quite small. From communications which the Bureau receives from time to time, it is evident that some fur-seal skins are being taken by Indians in British Columbia. No information is at hand to indicate that any considerable number of seals were taken by Alaskan natives in the calendar year 1917. A few skins are known to have been taken in the vicinity of Sitka, Alaska, by Indians in the spring of 1917, the seals having been speared, and it is reported that the natives still have these skins and understand that they must be authenticated if they are to become items of trade. In May and June, 1917, certain Indians of the State of Washington engaged in fur-seal hunting. The Bureau again secured, through the Department of the Interior, the cooperation of Dr. C. L. Woods, superintendent and physician in the United States Indian Service at Neah Bay, Wash., in the matter of authenticating the skins. To date (Aug. 17) the Bureau has received from Dr. Woods certificates in regard to 513 of these skins. These certificates indicate that all were speared from canoes and that 211 were taken from male seals and 302 from females.

#### MINOR FUR-BEARING ANIMALS OF ALASKA.

##### WORK OF THE WARDENS.

The force of wardens was active in the season of 1916-17, and was located as advantageously as possible with reference to the trapping operations. The shortage of funds for this service, occasioned by the greatly increased cost of supplies for the Pribilof Islands, restricted the movements of the wardens and impaired the efficiency of the service.

There have been several complaints and prosecutions for violations of the fur-bearing-animal laws and regulations of Alaska. Notwithstanding that strong evidence was submitted in the cases taken to court, no convictions resulted. The general sentiment, particularly in the sparsely populated and remote districts, is such that convictions for violations of the fur-bearing-animal laws and regulations are secured only with the greatest difficulty. In addition, a number of investigations have been made of complaints of alleged poisoning and illegal trapping.

##### REGULATIONS.

No new regulations governing the taking of fur-bearing animals were issued during the season 1916-17.

In connection with the total prohibition of the killing of martens for a period of five years from March 15, 1916, it has developed that certain trappers wished to retain possession of skins legally taken; and in order that no injustice might be done the owners of such skins, when they desired to ship them, arrangements were made for recording all these pelts that it was proposed to hold in Alaska after November 15, 1916. All shipments of marten skins from Alaska after that date will be checked against the records thus obtained. The Bureau has received 58 such reports, covering 3,031 pelts.

For some years the Post Office Department has aided the Department of Commerce in obtaining statistics of the furs shipped from Alaska by mail. An order of the Postmaster General dated May 4, 1917, published in the Postal Guide for June, reaffirmed the policy of cooperation and made certain changes in instructions to postmasters which will undoubtedly result in an improved service. The new order became effective October 1, 1917.

#### FURS SHIPPED FROM ALASKA.

Statistics compiled by the Bureau indicate that during the period from November 16, 1915, to November 15, 1916, the value of the furs shipped from Alaska was \$911,244, exclusive of the fur-seal and fox skins from the Pribilof Islands, as against \$400,532 in the preceding similar period. The leading fur bearers of the Territory are foxes, lynxes, minks, muskrats, and land otters. In 1916 there was a noteworthy increase in the number and value of most of the important pelts shipped to market. The number of lynx pelts was 21,608 against 9,374 in 1915, and the average price advanced from \$8 to \$12. The number of red-fox skins increased from 11,770 to 15,711, and the average price increased from \$8 to \$12. Over 101,000 muskrat skins came out in 1916 against less than 33,000 in the previous year. The shipment of mink skins fell off slightly but the average value advanced 100 per cent.

#### FUR FARMING IN ALASKA.

Although Alaska is well known as a producer of furs, it is not believed that its possibilities for fur farming, particularly the breeding of foxes, have been generally appreciated or recognized. There are various sections where it has been demonstrated that such operations may be conducted successfully. For several years past there have been a number of fur farms in operation on the Tanana and Yukon Rivers. The Copper River district is another section where fur farming has been prosecuted with a considerable measure of success. Still another region which has proved suitable is the Chilkat Valley in southeastern Alaska. Fur farming has also been conducted for many years on islands, particularly in the Afognak-Kodiak region, and islands to the westward, including the Shumagin Group.

In southeastern Alaska a number of islands have been devoted to fur farming, but except in one or two instances operations have not been successful. As in the case of other islands elsewhere in Alaska, this appears to have been due to the impression that it was only necessary to release a few pairs of foxes upon an island and in due time reap an easy harvest of pelts. In some cases even this indifferent method was moderately successful, but real success in the propagation of foxes on islands in Alaska has occurred only where intelligent supervision has been given. There has been a notable improvement along this line in recent years. It is now the custom on some of the islands and in all cases of fur farms on the mainland to construct carefully designed wire inclosures, or corrals, where the animals are subject to that attention which experience has demonstrated to be essential to success. There appears to be no reason why Alaska

should not assume a much more important rôle than heretofore in the business of fur farming.

At the end of the fiscal year 1917 four islands were under lease by the Department for the propagation of fur-bearing animals. These were Middleton, Simeonof, Little Koniui, and Marmot Islands. The lease of Carlson Island was canceled November 22, 1916, and Marmot Island was leased for five years, beginning September 1, 1916, at \$200 per year. Negotiations have been pending for the lease of Pearl Island.

### MISCELLANEOUS MATTERS.

#### SPECIAL CONSTRUCTIONS AND IMPROVEMENTS.

No new hatcheries or laboratories were authorized during the fiscal year but a number of special appropriations became available for improvements at several stations, and construction work was also in progress at various stations under former appropriations.

At Key West, Fla., the site of the marine biological laboratory authorized some years ago, a salt-water reservoir, 40 by 45 feet, has been excavated together with a canal 210 feet long connecting the reservoir with the open bay. The canal is to be provided with gates, and an ample supply of pure sea water is assured. Part of the foundation for the laboratory has been constructed, and plans and specifications for a residence building and pump house with provisional laboratory have been prepared and bids for their construction have been solicited. An additional appropriation of \$25,000 has been made, but it is evident that, under existing conditions, the amount provided is inadequate for the completion of an acceptable laboratory.

At the Louisville (Ky.) station, the construction work has included six concrete rearing ponds 8 by 20 feet, an earth pond 79 feet square for growing aquatic plants and minute animal food for young fish, and supply and drainage pipes. With the exception of a fence, this station is regarded as complete.

At the Springville (Utah) station, a hatchery and a superintendent's dwelling have been built. The hatchery, 34 by 97 feet, contains 120 troughs, with ample office, storage, and other rooms. The dwelling is a frame structure with 8 rooms and modern conveniences.

The old wooden flume for supplying water to the Duluth (Minn.) hatchery has been replaced by an iron pipe line.

Bids within the limits of the several appropriations for a retaining basin for brood fish at the Gloucester (Mass.) hatchery, for a lobster-rearing plant for New England, and for two new steel fish-distribution cars have not as yet been obtained.

The title to the property on Block Island, R. I., selected for a fish-cultural station as authorized by the act of Congress approved June 23, 1913, was found, on investigation, to be somewhat involved, and it was necessary, in accordance with the State law, to obtain from the probate court of the town of New Shoreham permission to sell the property. This was granted by decree of the court on October 2, 1916. The Legislature of the State of Rhode Island, in 1909, ceded to the town of New Shoreham all control over the waters within 1 mile of the shore of Block Island and granted the electors of that town authority to enact ordinances to protect and regulate

the taking of fish in Great Salt Pond. The act of the State legislature granting certain privileges to the United States Commissioner of Fisheries, approved by the governor of Rhode Island on May 11, 1914, therefore does not apply to the waters adjacent to the property selected on Block Island. In order to cover this privilege, the town council of the town of New Shoreham on June 20, 1917, passed the following resolution:

*Resolved*, That the United States Commissioner of Fisheries and his agents be and they are hereby granted unrestricted right to fish in the waters adjacent to Block Island and the right to conduct fish-cultural operations in any manner, at any time that may by them be considered necessary and proper, together with the right to fence in the small cove [adjoining the property selected] and the exclusive right to the use of this cove.

The Government, however, has not been able to accept the deed to the property as the State of Rhode Island has no law which cedes jurisdiction to the United States over the land which the Government may acquire for fish-cultural purposes. The governor of the State has been requested to assist in procuring the passage of such an act by the legislature during the next session, which meets in January, 1918.

At the Clackamas (Oreg.) station a new salmon hatchery was constructed with an appropriation that was made available in 1914. The structure is 58 by 100 feet. Its lighting is rendered almost perfect from white inside finish and 43 prism-glass windows. Other new buildings provided at this place were a combination carpenter shop and woodshed, 20 by 40 feet, a garage and lumber storage combination 22 by 30 feet, a pump house 12 by 18 feet, and a paint house 9 by 15 feet. All new buildings are on concrete foundations and so constructed that decaying floors can not affect the walls or other parts. The station is practically new and highly attractive in appearance. A new water system was installed with two electrically driven pumps, which are separate units. Their combined delivery is 1,600 gallons per minute, the discharge being into an excavated reservoir of 210,000 gallons capacity.

Taking advantage of the lull in fish-cultural operations at the Michigan stations during the first three months of the fiscal year, important repairs and improvements were made to the water supply and pond system at Northville, a special appropriation for the purpose having been obtained. The work included the grading and enlargement of the spawning space in two of the bass ponds, replacing 487 linear feet of old vitrified sewer crock connecting the dam and the water-supply reservoir with 16-inch iron pipe, and repairs to the retaining wall protecting the water-supply system.

#### CONSTRUCTION, REPAIR, AND MOVEMENTS OF VESSELS.

The act providing appropriations for the support of the Bureau for 1917 contained an item of \$10,000 for two motor boats for the Alaska fishery patrol. Bids for the construction of these boats were opened at Seattle on December 5, 1916, seven proposals being received. The contract was awarded to a local firm, the work began at once, and the boats were completed and accepted on May 10, 1917. The contract price was \$9,352, and the entire cost, including plans and inspection, was \$9,702.70. The boats resemble the type of boats used in the purse-

seine fishery for salmon, carry a crew of three men, and have accommodations for two fishery agents. They are 48 feet long and 12½ feet beam, draw 5½ feet of water, are lighted by electricity, are driven by 25 horsepower distillate engines, and have a normal speed of 8½ knots per hour. The fuel tanks have a capacity of 600 gallons, giving a radius of action of about 3,000 miles. The new boats, which have been named the *Auklet* and the *Murre*, after two common water birds of the Alaskan coast, left Seattle on July 7 for Alaska, reported at Wrangell on July 12, and immediately entered on fishery patrol work in southeast Alaska.

The steamer *Halcyon*, provided for the Boothbay Harbor station and described in last year's report, was launched November 30, 1916, and finally completed and accepted by the Bureau May 3, 1917. The vessel was immediately transferred to the Navy.

The steamer *Albatross* during the early part of the fiscal year continued the tuna investigation along the California coast until November 23, when she proceeded to San Francisco, arriving November 26. Soon afterward she was docked to ascertain what repairs and overhauling were necessary. A deficiency appropriation of \$10,000 becoming available on May 2, the vessel was taken to Mare Island Navy Yard where the work was undertaken. During the year the vessel cruised 4,833 miles, using 717.9 tons of coal at a cost of \$7,273.44.

The steamer *Fish Hawk* was engaged in fishery investigations in Chesapeake Bay, making trips at intervals from July 1, 1916, to March 22, 1917, since which time she has been chiefly on naval duty. Before the vessel can be used for any outside work, considerable repairs to the hull are necessary, and new engines should be provided. During the year the vessel, while employed in the service of the Bureau, cruised 681 miles, using 581 tons of coal at a cost of \$1,659.47.

The steamer *Roosevelt* sailed on January 23, 1917, from Norfolk en route to Seattle, where she arrived April 23, having been detained at Guantanamo over a month on account of the international situation and at Balboa nearly three weeks for repairs. At the end of the year she was ready to transport supplies to the Pribilof Islands.

The auxiliary schooner *Grampus* was engaged from July 18, 1916, to April 24, 1917, in oceanographic and other investigations on the Atlantic coast and fishery investigations in the Gulf of Mexico. In April the vessel reached Washington, and sailed thence on May 15 for Gloucester, Mass. Defects have developed in the hull of the *Grampus* incident to age and very active and continuous service, and the question is being considered as to whether the expense of rebuilding is warranted. The vessel is of an obsolete type and not at all suited to the present needs of the Bureau.

The steamer *Phalarope* has been utilized, as usual, in connection with the hatchery and laboratory at Woods Hole, Mass., and in shad hatching on the Potomac River; and the steamer *Gannet* has been actively employed at the Boothbay Harbor (Me.) station.

#### PUBLICATIONS.

The publications of the Bureau issued and distributed during the fiscal year are here noted. These were supplied chiefly through the Superintendent of Documents to persons on special mailing lists.

The Fisheries Service Bulletin, issued monthly, has proved very popular and useful. It is of special interest to employees, who are

thus kept informed of the current work of the service of which they are a component part. Every employee receives a copy of each issue and maintains a file. In the course of the year it was necessary at times to increase the number of pages to accommodate all the matter desirable for publication, and the monthly edition has also been enlarged.

Effective February 1, 1917, the Bureau discontinued the free distribution of its general publications. This action was necessitated by the increasing demands and the limited allotment available for printing. Hereafter applications for publications will be referred to the Superintendent of Documents, who will supply them at prices representing the actual cost of paper and press work. The only exceptions will be institutions and specialists collaborating or exchanging with the Bureau and State and foreign fishery officials. Documents issued in the Bureau's exploitation and propaganda work, together with the Commissioner's annual report, statistical bulletins, and the Fisheries Service Bulletin, will be supplied as heretofore.

#### REPORT OF THE COMMISSIONER AND APPENDIXES THERETO.

Report of the Commissioner of Fisheries to the Secretary of Commerce for the fiscal year ended June 30, 1916. 114 p.

Alaska fisheries and fur industries in 1915. By Ward T. Bower and Henry D. Aller. Appendix III to Report of Commissioner for 1915. 140 p.

Pacific cod fisheries. By John N. Cobb. Appendix IV to Report of Commissioner for 1915. 111 p., 9 pl., 1 map.

Survey of the fishing grounds on the coasts of Washington and Oregon in 1915. By Edward C. Johnston. Appendix VI to Report of Commissioner for 1915. 20 p., 4 charts.

Explorations of the United States Coast and Geodetic Survey steamer "Bache" in the western Atlantic, January-March, 1914, under the direction of the United States Bureau of Fisheries. By Henry F. Bigelow. Appendix V to Report of Commissioner for 1915. 62 p., 1 chart, 53 text fig.

Distribution of fish and fish eggs during the fiscal year 1916. By Henry O'Malley. Appendix I to Report of Commissioner for 1916. 112 p.

Pacific salmon fisheries (revised edition). By John N. Cobb. Appendix III to Report of Commissioner for 1916. 255 p., 29 pl.

Fish laws of Mississippi River States: A digest of statutes relating to the protection of fish and miscellaneous aquatic animals of States bordering on the Mississippi River. By Emerson Stringham. Appendix IV to Report of Commissioner for 1916. 20 p.

Condition and extent of the natural oyster beds and barren bottoms in the vicinity of Apalachicola, Fla. By Ernest Dangle. Appendix V to Report of Commissioner for 1916. 68 p., 1 map, 7 pl.

Fishing in the Priamur district of Siberia. By John K. Caldwell. Appendix VI to Report of Commissioner for 1916. 31 p.

Mortality of fishes on the west coast of Florida. By H. F. Taylor. Appendix III to Report of Commissioner for 1917. 24 p., 4 p. of pl.

#### BULLETIN OF THE BUREAU OF FISHERIES.

The structure and growth of the scales of the squeteague and pigfish as indicative of life history. By H. F. Taylor. Bulletin xxxiv, 1914, p. 285-330, 8 text fig., pl. I-LIX.

Notes on the fishes of east Tennessee. By Barton W. Evermann and Samuel F. Hildebrand. Bulletin xxxiv, 1914, p. 431-451, 13 text fig.

The histological basis of adaptive shades and colors in the flounder *Paralichthys albiguttus*. By Albert Kuntz. Bulletin xxxv, 1915-16, p. 1-30, 8 text fig., pl. I-II.

#### SPECIAL PUBLICATIONS.

Investigations, experiments, and surveys relative to the aquatic resources of the United States conducted by the Bureau of Fisheries during the fiscal year ended June 30, 1916. Extracted from Report of the Commissioner of Fisheries to the Secretary of Commerce for the fiscal year ended June 30, 1916, p. 34-49.

Commercial fisheries of the United States and the operations of the Bureau of Fisheries in connection therewith during the fiscal year ended June 30, 1916. Extracted from the Report of the Commissioner of Fisheries to the Secretary of Commerce for the fiscal year ended June 30, 1916, p. 50-100.

The work of the Bureau of Fisheries and its fish-cultural station at Boothbay Harbor, Me. 13 p., 6 text fig.

#### ECONOMIC CIRCULARS.

- No. 22. The grayfish. Try it. It knocks H out of the H. C. of L. 8 p., 1 text fig.
- No. 23. The sablefish, alias black cod. An introduction to one of the best and richest American food fishes, with recipes for cooking it. 6 p., 1 text fig.
- No. 24. Artificial propagation of the diamond-back terrapin. 21 p., 5 text fig. (Revised edition.)
- No. 25. The question of fishways. 6 p.
- No. 26. The burbot: A fresh-water cousin to the cod. 4 p., 1 text fig.
- No. 27. The bowfin: An old-fashioned fish with a new-found use. 4 p., 1 text fig.
- No. 28. A practical small smokehouse for fish. How to construct and operate it. 7 p., 3 text fig.
- No. 29. Preserving fish for domestic use. 2 p.

#### STATISTICAL BULLETINS.

Monthly and annual statements of the quantities and values of certain fishery products landed by American fishing vessels at the ports of Gloucester and Boston, Mass., Portland, Me., and Seattle, Wash.

#### SOME NEEDS OF THE FISHERIES SERVICE.

The Commissioner renews his previous recommendations for a modern building with ample laboratory facilities for the Washington headquarters combined with an aquarium for experimental and observational work in fish breeding, fish feeding, and fish pathology. The aquarium should be adapted for public education and should be recognized as a national institution. The need for and benefits to be derived from such a building are fully set forth in the Secretary's communication to the Speaker of the House of Representatives on April 2, 1917, printed as House Document No. 117, Sixty-fifth Congress, first session.

In order more adequately to perform the duties devolving on the Bureau, more particularly those that have received an added importance because of the national crisis that necessitates increased output of food and industrial materials, there is urgent need for additional personnel and facilities for practical and immediately productive work in furtherance of the activities hereinbefore referred to, in behalf of the exploitation of neglected aquatic resources, the methods of preservation best adapted to the various products and communities, and the prevention of waste in all branches of the fisheries. Items have been included in the estimates of appropriations for the next fiscal year that will meet some of the Bureau's needs in respect to these matters.

Respectfully submitted.

H. M. SMITH,  
*Commissioner of Fisheries.*

To Hon. WILLIAM C. REDFIELD,  
*Secretary of Commerce.*



# THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1917

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HENRY O'MALLEY

*Assistant in Charge of Fish Culture*

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Appendix I to the Report of the U. S. Commissioner of Fisheries for 1917

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## THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1917.

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### CHARACTER OF WORK.

The fish-cultural operations of the Bureau of Fisheries are directed to the restoration and maintenance of the commercial fisheries of the country and to the development and extension of the fish-producing area of its interior waters. The needs of the great fisheries industries, which embrace large investments of capital and contribute important food supplies of salmon, shad, codfish, lobster, etc., are paramount. The work of assembling and hatching the eggs of the commercial species and the liberating of the resulting fry in suitable waters have been unremittingly prosecuted by the Bureau, and there has been no relaxation of the efforts of past years to discover and develop new fields. A glance at the appended tabulation will disclose the magnitude of the distributions and the wide extent of territory covered. With an output of the size indicated it may readily be understood that it is necessary to liberate the greater portion of the fish during the very early stages of their existence.

The fishes furnished for the stocking of the streams, lakes, and ponds of the interior during the fiscal year 1917 were largely of the fingerling sizes. Of trout, grayling, and salmon it has been possible to produce requisite numbers with facility, but the species applicable to the needs of a considerable portion of the country—the so-called warm-water fishes—are in a different category, and the Bureau has been unable to supply them in numbers sufficient to meet the rapidly growing demands. The eggs of fishes of this class, owing to adhesiveness or other deterrent qualities, are not adapted to hatchery processes and resultant multiplication on a large scale. Their production is therefore limited to such numbers as the brood fishes themselves are able to bring off their nests in ponds where partial protection is afforded, and while the output of the pond fish-cultural stations is annually expanding, it is far from being adequate to satisfy public requirements.

To make up for the deficiency so far as practicable, recourse is had to collections of the young of black bass and kindred species which abound in the temporary lagoons existing at times in the high-water zones of the Mississippi and Illinois Rivers.

Early in the year these rivers overflow their banks and spread out over miles of territory, and in the warm shallows thus formed many varieties of the native game and food fishes deposit their eggs. The young fish hatched therefrom are imprisoned in immense numbers with the subsidence of the floods in the thousands of depressions ranging in depths from a few inches to several feet, and here they are preyed upon for several months by game birds and the alligator gar. Finally all that escape these enemies must perish incident to the drying of the pools in the fall. From depressions of this character the Bureau rescues many thousands of fish annually, returning by far the greater portion of them to the original streams, but culling out choice specimens to supplement its stock for distribution to applicants. This great resource is capable of being turned to highly successful account when funds are available for the extension of the rescue operations.

While only about 5 per cent of the Bureau's total output is applied to the interior waters of the country, the benefits accruing therefrom have been widely disseminated, and with the increasing cost of food materials this branch of the work is attaining greater significance. In its prosecution the Bureau has received valuable assistance from certain State fisheries authorities, club representatives, and public-spirited individuals, not only in formulating plans for but in the actual distributions of fishes. One highly important and beneficial effect of such cooperation has been the development and growth of a sentiment opposed to the ruthless and destructive fishing methods in vogue in many localities.

#### METHOD OF DISTRIBUTION.

The fry hatched from the shad, whitefish, salmons, lake trout, lake herring, pike perch, white perch, yellow perch, striped bass, cod, lobster, pollock, flatfish, and haddock—constituting the commercial species—are planted on the spawning grounds from which the eggs are derived or utilized for the stocking of new and suitable waters in an effort to extend the fisheries.

With respect to the game and food fishes of the interior, which are propagated in comparatively small numbers, provision is made for the return of a sufficient number of young fish to the waters where eggs are collected for the maintenance of the supply therein; the remainder of the stock is then assigned to suitable lakes or streams for which applications have been submitted by responsible individuals. This class includes the various trouts, basses, sunfishes, and catfishes.

Blanks upon which formal applications for fish can be made are furnished by the Bureau on request. Upon the receipt of applications properly executed and bearing the indorsement of a United States

Senator or Representative, an assignment of fish is made, suitable for the waters described and to the Bureau's facilities to supply, and the delivery is arranged for as soon as possible thereafter. Applicants should confine their choice of fishes to species that are indigenous to the region of the waters to be stocked. Nonindigenous species of fishes are assigned only upon the recommendation of the State fisheries authorities, and not then unless such recommendation conforms to the Bureau's judgment.

The Bureau refuses requests for such predaceous fishes as the black bass, sunfish, and kindred species for introduction into waters in California, Oregon, Washington, Idaho, Nevada, Wyoming, or western Montana, as it is believed their presence in such waters might prove harmful to the trout and salmon fisheries of that region.

Each species of fish spawns at a specific time during the year—the brook trout and the domesticated rainbow trout of eastern waters in the fall or early winter; the blackspotted trout, steelhead trout, and the wild rainbow trout of western waters during the spring; while all of the pond fishes reproduce in the spring or early summer.

The product of each season is distributed as the fish attain proper size for shipment, and after the exhaustion of the stock of one season no more are available until the same season the following year.

The distribution of trout in the Eastern States begins in March and is completed by the last of June, while trout shipments to applicants in the Middle States extend from about May 1 until well along in July. In the Rocky Mountain States the trout distributions occur somewhat later, the work usually starting by September 1 and continuing into the early winter.

The black basses produced at the Bureau's pond-cultural stations are distributed between May and August, while the miscellaneous fishes rescued from overflowed lands and the output of rock bass, crappie, sunfish, and catfish from these stations are shipped simultaneously, the distribution usually extending from August to December.

It is the policy of the Bureau to fill applications in the order of their receipt so far as practicable, but it is impossible to state definitely, in advance, when the fish requested by an applicant can be furnished, the approximate time of delivery depending upon transportation facilities, which are not always available on a given date, and, in the case of the pond or river fishes, upon the degree of success attained in the collections.

The number of fish assigned on an application must necessarily be governed by the available supply of the species requested and the time of year scheduled for the delivery, it being obvious that very young fishes which have not been fed can be furnished in much larger numbers than those which have been held at considerable expense at

the Bureau's stations until they have attained the size of fingerlings. It is the aim of the Bureau in all cases to allot a sufficient number of a given species to form a brood stock for the water area described, and those interested in the lake or stream so stocked are relied upon to see that the fish are afforded proper protection by the restriction or prohibition of fishing until a sufficient length of time has elapsed for them to reproduce, a period which will vary from two to three years, according to the species furnished.

Fry or very young fish can be shipped in much larger numbers than those of the fingerling sizes. A 10-gallon transportation can will safely carry from 2,000 to 3,000 fry of the trouts or black basses, from 500 to 1,000 one-inch fish of these species, and of those 2 inches long, from 100 to 300. It has been calculated that the varying numbers of the different sizes stated have practically equal value for stock purposes, as the losses in open waters from natural causes are in about the ratios indicated.

Some of the commercial species propagated—whitefish, pike perch, white perch, and shad, which are distributed only as fry—are so small that as many as 100,000 can be carried in a 10-gallon can.

Fish intended for applicants are carried to destination in specially equipped railroad cars belonging to the Bureau, or in the regular baggage cars attached to passenger trains, an experienced messenger accompanying them for the purpose of aerating the water en route. The only expense the applicant is put to in connection with the transaction is that of transporting the fish from the railroad station designated in the application to the waters in which they are to be liberated. Some days in advance of an intended delivery the consignee is notified and given detailed instructions regarding the reception and care of the fish after they are turned over to him. He is notified again by wire a few hours before the arrival, in order that he may meet the train and receive the consignment, which will be handed to him from the car by the messenger.

During the fiscal year ended June 30, 1917, the Bureau received 11,208 applications from individuals and associations for fish to stock public and private waters. Requests for blanks upon which to submit applications for fish should be addressed to the Commissioner of Fisheries, Washington, D. C.

## SPECIES CULTIVATED.

During the fiscal year 1917 the Bureau handled some 50 species of fish and the lobster. Of these the following were produced at its regular propagating stations:

## THE CATFISHES (SILURIDÆ):

Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).

Marbled cat (*Ameiurus nebulosus marmoratus*).

## THE SUCKERS AND BUFFALOFISHES (CATOSTOMIDÆ):

Smallmouth buffalofish (*Ictiobus bubalus*).

Common buffalofish (*Ictiobus cyprinella*).

Black buffalofish (*Ictiobus urus*).

## THE SHADS AND HERRINGS (CLUPEIDÆ):

Shad (*Alosa sapidissima*).

## THE SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ):

Common whitefish (*Coregonus albus* and *C. clupeaformis*).

Lake herring, cisco (*Leucichthys artedii*).

Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tshawytscha*).

Silver salmon, coho (*Oncorhynchus kisutch*).

Blueback salmon, redfish, sockeye (*Oncorhynchus nerka*).

Humpback salmon (*Oncorhynchus gorbuscha*).

Chum salmon (*Oncorhynchus keta*).

Steelhead (*Salmo gairdneri*).

Rainbow trout (*Salmo irideus*).

Atlantic salmon (*Salmo salar*).

Landlocked salmon (*Salmo sebago*).

Blackspotted trouts: Yellowstone Lake trout or cutthroat trout (*Salmo lewisi*);

Tahoe trout (*Salmo henshawi*).

Scotch sea trout (*Salmo trutta*). Introduced species.

Loch Leven trout (*Salmo trutta levenensis*). Introduced species, propagated in limited numbers for observation.

Lake trout, Mackinaw trout, longe, togue (*Cristivomer namaycush*).

Brook trout, speckled trout (*Salvelinus fontinalis*).

Sunapee Lake trout (*Salvelinus aureolus*).

## THE SMELTS (ARGENTINIDÆ):

American smelt (*Osmerus mordax*).

## THE GRAYLINGS (THYMALLIDÆ):

Montana grayling (*Thymallus montanus*).

## THE MACKERELS (SCOMBRIDÆ):

Common mackerel (*Scomber scombrus*).

## THE BUTTERFISHES (STROMATEIDÆ):

Butterfish (*Poronotus triacanthus*).

## THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):

Crappie (*Pomoxis annularis*).

Strawberry bass, calico bass (*Pomoxis sparoides*).

Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).

Warmouth, goggle-eye (*Chænobryttus gulosus*).

Smallmouth black bass (*Micropterus dolomieu*).

Largemouth black bass (*Micropterus salmoides*).

Bluegill bream, bluegill sunfish (*Lepomis incisor*).

Other sunfishes, chiefly *Eupomotis gibbosus*.

## THE PERCHES (PERCIDÆ):

Pike perch, wall-eyed pike, yellow pike, blue pike (*Stizostedion vitreum*).  
Yellow perch, ring perch (*Perca flavescens*).

## THE SEA BASSES (SERRANIDÆ):

Striped bass, rockfish (*Roccus lineatus*).  
White perch (*Morone americana*).

## THE CODS (GADIDÆ):

Cod (*Gadus callarias*).  
Haddock (*Melanogrammus ægloffinus*).  
Pollock (*Pollachius virens*).

## THE FLOUNDERS (PLEURONECTIDÆ):

Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

## CRUSTACEANS:

American lobster (*Homarus americanus*).

The fishes rescued from overflowed lands in the Mississippi Basin and returned to the original streams were as follows:

## THE CATFISHES (SILURIDÆ):

Spotted cat, blue cat, channel cat (*Ictalurus punctatus*).  
Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).

## THE SUCKERS AND BUFFALOFISHES (CATOSTOMIDÆ):

Common sucker (*Catostomus commersonii*).  
Black sucker (*Hypentelium nigricans*).  
Smallmouth buffalofish (*Ictiobus bubalus*).  
Common buffalofish (*Ictiobus cyprinella*).  
Black buffalofish (*Ictiobus urus*).

## THE MINNOWS AND CARPS (CYPRINIDÆ):

Carp (*Cyprinus carpio*).

## THE PIKES AND PICKERELS (ESOCIDÆ):

Pike (*Esox lucius*).  
Pickerel (*Esox reticulatus*).

## THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):

Crappie (*Pomoxis annularis*).  
Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).  
Warmouth, goggle-eye (*Chænobryttus gulosus*).  
Largemouth black bass (*Micropterus salmoides*).  
Smallmouth black bass (*Micropterus dolomieu*).  
Bluegill bream, bluegill sunfish (*Lepomis incisor*).  
Other sunfishes, chiefly *Eupomotis gibbosus*.

## THE PERCHES (PERCIDÆ):

Yellow perch, ring perch (*Perca flavescens*).

## THE SEA BASSES (SERRANIDÆ):

White bass (*Roccus chrysops*).  
Yellow bass (*Morone interrupta*).



## SUMMARIZED STATEMENT OF DISTRIBUTION.

The following table shows the number of fish and eggs actually distributed during the fiscal year 1917, or, in other words, the output of the hatcheries, with all losses in transportation deducted:

SUMMARY, BY SPECIES, OF THE DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR ENDED JUNE 30, 1917.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish.....			4,251,289	4,251,289
Carp.....		112,000	605,407	717,407
Buffalofish.....		6,754,000	207,898	6,961,898
Suckers.....			748	748
Shad.....		77,946,000		77,946,000
River herring.....			177,000	177,000
Whitefish.....	52,602,500	331,610,000		384,212,500
Lake herring (cisco).....		82,550,000		82,550,000
Silver salmon.....		4,403,700	4,662,960	9,066,660
Chinook salmon.....	7,191,200	16,404,404	27,065,581	50,661,185
Blueback salmon.....	2,000,000	75,038,525	5,793,953	82,832,478
Humpback salmon.....		27,406,204	7,449,030	34,855,234
Chum salmon.....		14,403,300	7,014,580	21,417,880
Steelhead trout.....	3,237,600	2,040,710	2,061,709	7,340,019
Rainbow trout.....	1,454,200	250,200	2,574,942	4,279,342
Atlantic salmon.....		3,028,850	887	3,029,737
Landlocked salmon.....	531,000	798,689	177,635	1,507,324
Blackspotted trout.....	1,630,000	2,051,400	2,683,900	6,365,300
Loch Leven trout.....			25,860	25,860
Lake trout.....	35,332,000	33,395,155	3,699,158	72,426,313
Brook trout.....	935,600	5,972,495	7,868,932	14,777,027
Sunapee trout.....		8,000		8,000
Grayling.....	125,000	1,078,000		1,203,000
Smelt.....		28,000,000		28,000,000
Pike and pickerel.....			103,643	103,643
Freshwater drum.....			29,804	29,804
Crappies.....			1,565,072	1,565,072
Largemouth black bass.....		320,050	961,912	1,281,962
Smallmouth black bass.....		237,600	149,837	387,437
Rock bass.....			91,742	91,742
Warmouth bass.....			2,400	2,400
Sunfish.....			2,670,513	2,670,513
Pike perch.....	212,900,000	174,097,500	15,874	387,013,374
Yellow perch.....		175,421,000	163,839	175,584,839
White perch.....		32,625,000		32,625,000
White bass.....			15,298	15,298
Yellow bass.....			15	15
Striped bass.....		16,137,000		16,137,000
Mackerel.....		2,341,000		2,341,000
Butterfish.....		920,000		920,000
Cod.....	1,000,000	236,786,000	2,648	237,788,648
Pollock.....		1,474,096,000		1,474,096,000
Haddock.....		6,720,000		6,720,000
Flounder.....		1,814,696,000		1,814,696,000
Miscellaneous fishes.....			15,945	15,945
Lobster.....		110,260,000	5,400	110,265,400
Total.....	318,939,100	4,757,908,782	82,115,411	5,158,963,293

## ALLOTMENTS OF FISH AND EGGS TO STATE FISH COMMISSIONS, FISCAL YEAR 1917.

State and species.	Eggs and fry. <sup>a</sup>	Fingerlings, yearlings, and adults.	State and species.	Eggs and fry. <sup>a</sup>	Fingerlings, yearlings, and adults.
California: Chinook salmon.....	7,027,300	.....	New York:		
Illinois:			Lake trout.....	5,490,000	.....
Black bass.....		7,000	Landlocked salmon.....	25,000	.....
Brook trout.....	50,000	.....	Pike perch.....	*6,600,000	.....
Catfish.....		10,500	Steelhead.....	500,000	.....
Crappie.....		300	Yellow perch.....	*250,000	.....
Pike perch.....	15,000,000	.....	North Dakota:		
Rainbow trout.....	50,000	.....	Pike perch.....	3,000,000	.....
Sunfish.....		4,000	Steelhead.....	100,000	.....
Whitefish.....	5,000,000	.....	Ohio:		
Yellow perch.....		250	Lake trout.....	600,000	.....
Indiana: Pike perch.....	15,000,000	.....	Pike perch.....	73,600,000	.....
Iowa:			Whitefish.....	40,980,000	.....
Brook trout.....	50,000	.....	Oklahoma:		
Lake trout.....	100,000	.....	Black bass.....		70
Pike perch.....	40,000,000	.....	Catfish.....		10
Kentucky:			Rock bass.....		80
Black bass.....		88	Sunfish.....		90
Chinook salmon.....		6,000	Yellow perch.....	*100,000	60
Crappie.....		2,800	Oregon:		
Pike perch.....	*5,000,000	.....	Blackspotted trout.....	250,000	.....
Rainbow trout.....		10,000	Blueback salmon.....	2,000,000	.....
Rock bass.....		1,050	Chinook salmon.....	163,900	60,000
Sunfish.....		4,200	Lake trout.....	1,000,000	.....
Maine:			Silver salmon.....		10,000
Brook trout.....	100,000	.....	Steelhead.....	1,687,600	.....
Lake trout.....	200,000	.....	Pennsylvania:		
Landlocked salmon.....	401,000	.....	Lake trout.....	1,000,000	.....
Massachusetts: Catfish.....		12,500	Rainbow trout.....	50,000	.....
Michigan:			Pike perch.....	8,000,000	.....
Grayling.....	50,000	.....	South Dakota:		
Lake trout.....	8,640,000	.....	Blackspotted trout.....	*30,000	.....
Pike perch.....	*2,000,000	.....	Brook trout.....		23,150
Whitefish.....	40,000,000	.....	Pike perch.....	3,000,000	.....
Minnesota:			Utah: Blackspotted trout.....	100,000	.....
Lake trout.....	3,300,000	.....	Vermont:		
Steelhead.....	200,000	.....	Channel catfish.....		100
Whitefish.....	122,500	.....	Lake trout.....	1,500,000	.....
Missouri: Rainbow trout.....	98,400	.....	Landlocked salmon.....	40,000	.....
Montana:			Steelhead.....	200,000	.....
Black bass.....		7,500	Washington: Blackspotted trout.....	200,000	.....
Blackspotted trout.....	400,000	.....	Wisconsin:		
Catfish.....		2,000	Lake trout.....	13,000,000	.....
Rainbow trout.....	150,000	.....	Whitefish.....	5,000,000	.....
Whitefish.....	300,000	.....	Wyoming:		
Nebraska: Pike perch.....	9,800,000	.....	Blackspotted trout.....	300,000	.....
Nevada: Brook trout.....	150,000	.....	Lake trout.....	200,000	.....
New Hampshire:			Rainbow trout.....	100,000	.....
Brook trout.....	50,000	.....	Steelhead.....	100,000	.....
Landlocked salmon.....	25,000	.....			
Rainbow trout.....	100,000	.....	Total.....	{ *14,230,000 308,700,700 }	163,248
New Jersey:					
Rainbow trout.....	50,000	.....			
Smallmouth black bass.....		1,500			
Steelhead.....	100,000	.....			

<sup>a</sup> Fry are indicated by an asterisk, thus (\*); all others are eggs.

## SHIPMENTS OF FISH AND EGGS TO CANAL ZONE AND FOREIGN COUNTRIES DURING FISCAL YEAR 1917.

Country and species.	Eggs.	Fingerlings.
Canada: Rainbow trout.....	96,000	.....
Japan:		
Brook trout.....	100,000	.....
Rainbow trout.....	101,000	.....
Canal Zone:		
Black bass.....		450
Catfish.....		1,000
Rock bass.....		500
Sunfish.....		800
Total.....	297,000	2,750

## DETAILS OF OUTPUT FOR 1917.

The following table shows the work of the different stations in 1917, the period of operations, and the eggs and fish furnished by each station for distribution. It will be noted that transfers of fish and eggs from station to station are frequent. Such transfers are made in the interest of economy and convenience where the shipments consist of eggs, and give advantageous distribution centers in the case of young fish.

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917.

[NOTE.—See explanations of this table on p. 17.]

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Afognak, Alaska: <sup>a</sup>					
Entire year.....	Blueback salmon.....		13,576,700	2,200,000	15,776,700
	Humpback salmon.....		19,343,000		19,343,000
Baird, Cal.:					
Entire year.....	Brook trout.....			26,000	26,000
	Chinook salmon.....			3,702,000	3,702,000
	Rainbow trout.....			19,450	19,450
Battle Creek, Cal. <sup>b</sup> —					
Dec.—Apr.....	Chinook salmon.....	5,000,000		5,695,300	10,695,300
Hornbrook, Cal.—					
Jan.—May.....	Chinook salmon.....	1,000,000	800,000	368,000	2,168,000
	Rainbow trout.....	175,000	11,200		186,200
	Silver salmon.....		50,000	11,000	61,000
Mill Creek, Cal. <sup>c</sup> —					
Dec.—Apr.....	Chinook salmon.....	1,027,300		4,863,000	5,890,300
Baker Lake, Wash.:					
Entire year.....	Blueback salmon.....		711,825	1,996,000	2,807,825
	Chinook salmon.....		85,581		85,581
	Silver salmon.....			508,900	508,900
	Steelhead.....		66,510		66,510
Birdsview, Wash. <sup>d</sup> —					
Entire year.....	Blueback salmon.....			97,000	97,000
	Chum salmon.....			928,010	928,010
	Humpback salmon.....		165,000	3,563,810	3,728,810
	Silver salmon.....			1,980,000	1,980,000
	Steelhead.....	550,000		1,424,000	1,974,000
Brinnon, Wash.—					
Entire year.....	Chum salmon.....		892,800		892,800
	Silver salmon.....		197,400		197,400
	Steelhead.....		242,800		242,800
Darrington, Wash.—					
Apr.—June.....	Chum salmon.....		277,000		277,000
	Silver salmon.....		700,000		700,000
Duckabush, Wash.—					
Entire year.....	Chinook salmon.....			706,507	706,507
	Chum salmon.....		2,402,000	5,838,520	8,240,520
	Humpback salmon.....			1,960,120	1,960,120
	Silver salmon.....		38,000	1,823,960	1,861,960
	Steelhead.....		689,700		689,700
Illabott Creek, Wash.—					
Oct.—June.....	Chinook salmon.....			44,105	44,105
	Chum salmon.....		1,831,000		1,831,000
	Silver salmon.....		259,600		259,600
Quilcene, Wash.—					
Entire year.....	Chum salmon.....		7,553,000		7,553,000
	Humpback salmon.....			1,925,100	1,925,100
	Silver salmon.....			247,000	247,000
	Steelhead.....		626,500		626,500
Sultan, Wash.—					
Entire year.....	Silver salmon.....		855,000		855,000
	Steelhead.....		353,500		353,500
Boothbay Harbor, Me.:					
Entire year.....	Flounder.....		966,266,000		966,266,000
	Lobster.....		110,000,000	5,400	110,005,400
	Pollock.....		3,346,000		3,346,000
Bozeman, Mont.: <sup>e</sup>					
Entire year.....	Blackspotted trout.....		1,072,000		1,072,000
	Brook trout.....			363,850	363,850
	Grayling.....	125,000	968,000		1,093,000
	Lake trout.....			37,500	37,500
	Rainbow trout.....	253,000	60,000	664,100	977,100
	Steelhead.....			10,000	10,000

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917—Contd

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Bozeman, Mont.—Contd.					
Yellowstone, Wyo.—					
July–Sept.	Blackspotted trout	1,630,000	193,000		1,823,000
Bryans Point, Md.:g					
Mar.–May.	Shad.		68,665,000		68,665,000
	Yellow perch		130,370,000		130,370,000
Cape Vincent, N. Y.:					
Entire year.	Brook trout		831,000		831,000
	Lake herring.		82,550,000		82,550,000
	Lake trout.		6,315,155		6,315,155
	Landlocked salmon		4,970		4,970
	Pike perch.		10,875,000		10,875,000
	Rainbow trout.		91,000		91,000
	Whitefish		19,550,000		19,550,000
	Yellow perch		26,000,000	50,000	26,050,000
Central Station, Wash- ington, D. C.:					
Entire year.	Black bass.			700	700
	Brook trout.		16,000		16,000
	Catfish.			275	275
	Crappie.			350	350
	Pike perch.		1,200,000		1,200,000
	Rainbow trout.		8,000		8,000
	Rock bass.			200	200
	Shad.		600,000		600,000
	Smallmouth black bass			320	320
	Suckers.			100	100
	Sunfish.			1,525	1,525
	Whitefish.		630,000		630,000
	Yellow perch			1,385	1,385
Clackamas, Oreg.:					
Entire year.	Brook trout.			127,000	127,000
	Chinook salmon.			3,991,700	3,991,700
	Rainbow trout.			40,000	40,000
	Silver salmon.			14,400	14,400
	Steelhead.			20,000	20,000
Applegate, Oreg.—					
Apr.–June.	Chinook salmon.		171,500		171,500
	Silver salmon.		393,700		393,700
	Steelhead.	2,287,600	34,500		2,322,100
Big White Salmon, Wash.—					
Dec.–Mar.	Chinook salmon.		4,310,958	567,290	4,878,248
Snake River, Oreg.—					
Oct.	do.	163,900			163,000
Little White Salmon, Wash.—					
July–May.	do.		10,413,365	4,547,279	14,960,644
	Chum salmon.		1,447,500	248,050	1,695,550
Rogue River, Oreg.—					
Entire year.	Blackspotted trout.			8,000	8,000
	Chinook salmon.			1,758,800	1,758,800
	Silver salmon.			6,000	6,000
	Steelhead.			128,600	128,600
Upper Clackamas, Oreg.—					
Entire year.	Chinook salmon.		463,000	815,600	1,278,600
	Silver salmon.			71,700	71,700
	Steelhead.	400,000		318,850	718,850
Willamette, Oreg.—					
July and June.	Shad.		2,351,000		2,351,000
Cold Springs, Ga.:					
Entire year.	Black bass.		46,000	134,120	180,120
	Catfish.			4,525	4,525
	Sunfish.			57,525	57,525
Milltown, Ga.—					
May.	Black bass.			100,000	100,000
Craig Brook, Me.:					
Entire year.	Atlantic salmon.		3,028,850	887	3,029,737
	Brook trout.		962,000	41,300	1,003,300
	Humpback salmon.		3,961,439		3,961,439
	Landlocked salmon.		7,480	20,850	28,330
Duluth, Minn.:					
Entire year.	Brook trout.		152,000	364,500	561,500
	Lake trout.	4,200,000	11,453,000	3,502,000	19,155,000
	Pike perch.		5,087,500		5,087,500
	Steelhead.			105,000	105,000
	Whitefish.	122,500	7,130,000		7,252,500
Edenton, N. C.:					
Entire year.	Black bass.		19,100	37,600	56,700
	Shad.		6,060,000		6,060,000
	Sunfish.			7,900	7,900
	White perch.		32,625,000		32,625,000

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917—Contd.

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Edenton, N. C.—Contd.					
Weldon, N. C.—					
Apr.-May.....	Striped bass.....		16,137,000		16,137,000
Erwin, Tenn.:}	Black bass.....		27,000	2,690	29,690
Entire year.....	Brook trout.....			182,425	182,425
	Carp.....			2,000	2,000
	Rainbow trout.....			332,502	332,502
	Rock bass.....			25,450	25,450
	Smallmouth black bass.....		11,000	1,700	12,700
	Sunfish.....			8,135	8,135
Fairport, Iowa:	Black bass.....			6,349	6,349
Entire year.....	Buffalo fish.....		6,754,000	2,737	6,756,737
	Carp.....		112,000	4,741	116,741
	Catfish.....			112,952	112,952
	Crappie.....			43,335	43,335
	Drum.....			529	529
	Pickereel.....			205	205
	Pike perch.....			606	606
	Sunfish.....			69,424	69,424
	White bass.....			498	498
	Yellow perch.....			305	305
	Miscellaneous.....			3,557	3,557
Black River, Ark.—	Black bass.....			803	803
Oct.-Dec.....	Buffalo fish.....			123	123
	Carp.....			6	6
	Catfish.....			15,232	15,232
	Crappie.....			1,900	1,900
	Pike perch.....			83	83
	Suckers.....			186	186
	Sunfish.....			3,904	3,904
	Miscellaneous.....			1,922	1,922
Cumberland River, Ky.—	Black bass.....			136	136
Nov.-Dec.....	Crappie.....			4,921	4,921
	Sunfish.....			2,831	2,831
	Miscellaneous.....			1,041	1,041
Lake Cooper, Ill.—	Black bass.....			192	192
Aug.-Dec.....	Buffalo fish.....			788	788
	Carp.....			449	449
	Catfish.....			32	32
	Crappie.....			1,104	1,104
	Pickereel.....			33	33
	Pike perch.....			11	11
	Sunfish.....			689	689
	Yellow perch.....			47	47
	Miscellaneous.....			398	398
Lake Pepin, Minn.—	Black bass.....			2,970	2,970
Sept.-Nov.....	Buffalo fish.....			1,099	1,099
	Carp.....			6,921	6,921
	Catfish.....			716,772	716,772
	Crappie.....			13,325	13,325
	Pickereel.....			946	946
	Pike perch.....			59	59
	Suckers.....			462	462
	Sunfish.....			11,977	11,977
	Yellow perch.....			4,970	4,970
	Miscellaneous.....			9,017	9,017
Gloucester, Mass.:k	Butterfish.....		920,000		920,000
Entire year.....	Cod.....		66,610,000		66,610,000
	Flounder.....		169,660,000		169,660,000
	Haddock.....		6,720,000		6,720,000
	Lobster.....		260,000		260,000
	Mackerel.....		495,000		495,000
	Pollock.....		1,470,750,000		1,470,750,000
Green Lake, Me.:}	Brook trout.....		1,358,676		1,358,676
Entire year.....	Humpback salmon.....		3,950,100		3,950,100
	Landlocked salmon.....	301,000		80,000	973,719
	Smelt.....		28,000,000		28,000,000
	Steelhead.....		27,200		27,200
Grand Lake Stream, Me. l—	Brook trout.....		23,600		23,600
Sept.-June.....	Landlocked salmon.....	234,000	234,000	73,814	537,814

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917—Contd.

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Homer, Minn.: Entire year.....	Black bass.....			58,731	58,731
	Brook trout.....		40,500		40,500
	Buffalofish.....			76,725	76,725
	Carp.....			443,053	443,053
	Catfish.....			1,571,442	1,571,442
	Crappie.....			677,782	677,782
	Drum.....			200	200
	Pike and pickerel.....			38,909	38,909
	Pike perch.....		9,950,000	2,615	9,952,615
	Rainbow trout.....			14,200	14,200
	Rock bass.....			124	124
	Sunfish.....			442,786	442,786
	Yellow perch.....		150,000	50,505	200,505
La Crosse, Wis.: Entire year.....	Black bass.....			57,100	57,100
	Brook trout.....			130,330	130,330
	Buffalofish.....			12,500	12,500
	Carp.....			78,000	78,000
	Catfish.....			805,600	805,600
	Crappie.....			219,310	219,310
	Drum.....			26,000	26,000
	Pike and pickerel.....			26,500	26,500
	Pike perch.....			12,500	12,500
	Rock bass.....			1,330	1,330
	Strawberry bass.....			10,000	10,000
	Sunfish.....			293,000	293,000
	White bass.....			10,300	10,300
	Yellow perch.....			34,050	34,050
Leadville, Colo.: Entire year.....	Blackspotted trout.....			1,839,000	1,839,000
	Brook trout.....	925,000		3,312,800	4,237,800
	Grayling.....		110,000		110,000
	Lake trout.....			50,000	50,000
	Rainbow trout.....			151,000	151,000
Louisville, Ky.: Entire year.....	Black bass.....			6,090	6,090
	Chinook salmon.....			6,000	6,000
	Crappie.....			1,575	1,575
	Pike perch.....		8,800,000		8,800,000
	Rainbow trout.....			10,000	10,000
	Rock bass.....			2,525	2,525
	Smallmouth black bass.....			5,500	5,500
	Sunfish.....			10,175	10,175
Mammoth Spring, Ark.: Entire year.....	Black bass.....			6,555	6,555
	Catfish.....			207	207
	Rock bass.....			14,753	14,753
	Smallmouth black bass.....			50,065	50,065
	Sunfish.....			25,562	25,562
Friars Point, Miss.: July-Dec.....	Black bass.....			7,587	7,587
	Buffalofish.....			3,296	3,296
	Carp.....			1,847	1,847
	Catfish.....			9,952	9,952
	Crappie.....			7,320	7,320
	Rock bass.....			1,110	1,110
	Sunfish.....			49,768	49,768
Manchester, Iowa.: Entire year.....	Brook trout.....			529,607	529,607
	Rainbow trout.....	391,000		125,250	516,250
	Rock bass.....			9,555	9,555
	Smallmouth black bass.....		3,000	200	3,200
Bellevue, Iowa p— Aug.-Dec.....	Black bass.....			73,356	73,356
	Buffalofish.....			47,400	47,400
	Carp.....			33,300	33,300
	Catfish.....			386,065	386,065
	Crappie.....			194,278	194,278
	Drum.....			1,875	1,875
	Pike and pickerel.....			8,900	8,900
	Strawberry bass.....			105	105
	Sunfish.....			783,750	783,750
	Warmouth bass.....			400	400
	White bass.....			4,500	4,500
	Yellow perch.....			3,010	3,010

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917—Contd.

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Manchester, Iowa—Contd. North McGregor, Iowa— Aug.—Dec.....	Black bass.....	.....	.....	84,200	84,200
	Buffalofish.....	.....	.....	55,060	55,060
	Carp.....	.....	.....	26,290	26,290
	Catfish.....	.....	.....	582,690	582,690
	Crappie.....	.....	.....	271,850	271,850
	Pike and pickerel.....	.....	.....	20,050	20,050
	Rock bass.....	.....	.....	200	200
	Sunfish.....	.....	.....	487,676	487,676
	Yellow perch.....	.....	.....	12,120	12,120
Galena, Ill.— Nov.....	Black bass.....	.....	.....	8,000	8,000
	Buffalofish.....	.....	.....	8,000	8,000
	Carp.....	.....	.....	8,800	8,800
	Catfish.....	.....	.....	46,500	46,500
	Crappie.....	.....	.....	93,000	93,000
	Drum.....	.....	.....	1,200	1,200
	Pike and pickerel.....	.....	.....	8,100	8,100
	River herring.....	.....	.....	177,000	177,000
	Sunfish.....	.....	.....	193,000	193,000
	Warmouth bass.....	.....	.....	2,000	2,000
	Yellow perch.....	.....	.....	3,700	3,700
Nashua, N. H.: Entire year.....	Brook trout.....	.....	.....	817,200	817,200
	Lake trout.....	.....	.....	60,600	60,600
	Rainbow trout.....	.....	.....	77,000	77,000
	Smallmouth black bass.....	.....	6,000	11,435	17,435
Neosho, Mo.: Entire year.....	Black bass.....	.....	950	24,033	24,983
	Crappie.....	.....	.....	5,750	5,750
	Rainbow trout.....	98,400	.....	56,066	154,466
	Rock bass.....	.....	.....	8,530	8,530
	Smallmouth black bass.....	.....	600	1,503	2,103
	Sunfish.....	.....	.....	24,440	24,440
	Yellow perch.....	.....	201,000	1,174	202,174
Northville, Mich.: Entire year.....	Blackspotted trout.....	.....	5,000	.....	5,000
	Brook trout.....	.....	608,000	110,000	718,000
	Lake trout.....	31,132,000	864,000	.....	31,996,000
	Rainbow trout.....	.....	33,000	12,000	45,000
	Smallmouth black bass.....	.....	111,000	73,025	184,025
Alpena, Mich.— Apr.—May.....	Lake trout.....	.....	3,298,000	.....	3,298,000
	Whitefish.....	.....	25,800,000	.....	25,800,000
Charlevoix, Mich.— Apr.—May.....	Lake trout.....	.....	10,500,000	.....	10,500,000
	Whitefish.....	.....	30,000,000	.....	30,000,000
Detroit, Mich.— Dec.—June.....	Pike perch.....	40,500,000	9,750,000	.....	50,250,000
	Whitefish.....	.....	40,000,000	.....	40,000,000
Orangeburg, S. C.: Entire year.....	Black bass.....	.....	.....	142,672	142,672
	Sunfish.....	.....	.....	60,700	60,700
	Shad.....	.....	270,000	.....	270,000
Put in Bay, Ohio: <sup>u</sup> Entire year.....	Lake trout.....	.....	990,000	.....	990,000
	Pike perch.....	172,000,000	115,500,000	.....	287,500,000
	Whitefish.....	52,480,000	208,500,000	.....	260,980,000
Quinalt, Wash.: <sup>v</sup> Entire year.....	Blueback salmon.....	.....	11,150,000	52,953	11,202,953
	Chinook salmon.....	.....	160,000	.....	160,000
	Silver salmon.....	.....	1,910,000	.....	1,910,000
Quincy, Ill.: <sup>w</sup> Entire year.....	Black bass.....	.....	.....	35,578	35,578
	Buffalofish.....	.....	.....	170	170
	Catfish.....	.....	.....	2,200	2,200
	Crappie.....	.....	.....	20,168	20,168
	Pike perch.....	.....	1,450,000	.....	1,450,000
	Rock bass.....	.....	.....	24	24
	Sunfish.....	.....	.....	65,604	65,604
	Yellow bass.....	.....	.....	15	15
	Yellow perch.....	.....	.....	1,217	1,217
St. Johnsbury, Vt.. Entire year.....	Brook trout.....	7,000	1,340,209	61,920	1,409,120
	Lake trout.....	.....	.....	9,488	9,488
	Landlocked salmon.....	.....	.....	7,761	7,761
	Rainbow trout.....	.....	.....	24,000	24,000
	Smallmouth black bass.....	.....	3,000	4,611	7,611

## STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1917—Contd.

Station and period of operation.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
St. Johnsbury, Vt.—Con. Entire year.....	Steelhead .....			32,750	32,750
	Sunapee trout.....		8,000		8,000
	Yellow perch.....			1,356	1,356
Berkshire, Mass.— Entire year.....	Brook trout.....		77,000	179,995	256,995
Holden, Vt.— Entire year.....	Brook trout.....		569,500	2,300	571,800
	Lake trout.....			8,635	8,635
	Landlocked salmon.....			4,260	4,260
	Rainbow trout.....			1,007	1,007
	Steelhead.....			16,509	16,509
Swanton, Vt.— Apr.—May.....	Pike perch.....		11,900,000		11,900,000
	Yellow perch.....		18,700,000		18,700,000
San Marcos, Tex.: Entire year.....	Black bass.....		5,000	85,656	90,656
	Crappie.....			30	30
	Rock bass.....			12,991	12,991
	Sunfish.....			22,522	22,522
Saratoga, Wyo.: Entire year.....	Blackspotted trout.....		185,000	685,000	870,000
	Brook trout.....			45,000	45,000
	Rainbow trout.....			212,000	
	Steelhead.....			9,500	9,500
Spearfish, S. Dak.: Entire year.....	Blackspotted trout.....		597,400	166,400	763,800
	Brook trout.....			707,650	707,650
	Lake trout.....			32,500	32,500
	Loch Leven trout.....			25,860	25,860
	Rainbow trout.....		47,000	101,600	148,600
Tupelo, Miss.: Entire year.....	Black bass.....		222,000	78,015	300,015
	Catfish.....			800	800
	Crappie.....			125	125
	Sunfish.....			48,450	48,450
White Sulphur Springs, W. Va.: Entire year.....	Black bass.....			1,300	1,300
	Brook trout.....	3,600		770,055	773,655
	Rainbow trout.....	6,800		248,600	255,400
	Smallmouth black bass.....		92,000	1,500	93,500
	Sunfish.....			6,000	6,000
Woods Hole, Mass.: Entire year.....	Cod.....	1,000,000	170,178,000	2,648	171,180,648
	Flounder.....		678,770,000		678,770,000
	Mackerel.....		1,846,000		1,846,000
Wytheville, Va.: Entire year.....	Black bass.....			10,030	10,030
	Brook trout.....			97,900	97,900
	Rainbow trout.....	530,000		506,445	1,036,445
	Rock bass.....			15,350	15,350
	Smallmouth black bass.....		11,000	1,295	12,295
	Sunfish.....			1,570	1,570
Yes Bay, Alaska: Entire year.....	Blueback salmon.....	2,000,000	49,600,000	1,448,000	53,048,000
Total output.....		318,939,100	4,758,402,117	82,190,463	5,159,531,680
Lost in transit.....			493,335	75,052	568,387
Net output.....		318,939,100	4,757,908,782	82,115,411	5,158,963,293



## TRANSFER NOTES TO PRECEDING TABLE.

For convenience in handling, transfers were made as follows:

- a* Afognak to Craig Brook, 4,096,000; to Green Lake, 4,106,752; to Birdsvlew, 4,000,000; to Duckabush, 2,000,000; to Quileene, 2,000,000 humpback salmon eggs.
- b* Battle Creek to Baird, 2,598,500 chinook salmon eggs.
- c* Mill Creek to Baird, 413,300 chinook salmon eggs.
- d* Birdsvlew to Central Station, 20,000 chinook salmon eggs; to Duluth, 100,000; to Leadville, 100,000; to Green Lake, 50,000; to Saratoga, 100,000; to St. Johnsbury, 100,000; to Holden, 50,000 steelhead trout eggs.
- e* Bozeman to Leadville, 175,000 grayling eggs; to Wytheville, 25,000; to Leadville, 100,000; to Clackamas, 237,000 rainbow trout eggs.
- f* Yellowstone to Leadville, 2,015,400; to Spearfish, 975,000; to Saratoga, 890,000 blackspotted trout eggs.
- g* Bryans Point to Central Station, 2,600,000 yellow perch eggs.
- h* Little White Salmon to Louisville, 20,000 chinook salmon eggs.
- i* Duluth to Leadville, 50,000; to Spearfish, 50,000; to Bozeman, 50,000 lake trout eggs.
- j* Erwin to Orangeburg, 4,000 rock bass fingerlings.
- k* Gloucester to Boothbay Harbor, 34,430,000 pollock eggs.
- l* Grand Lake Stream to St. Johnsbury, 30,000; to Cape Vincent, 5,000; to Craig Brook, 10,000 landlocked salmon eggs.
- m* Homer to San Marcos, 8,600 crappie fingerlings; to North McGregor, 600 sunfish; 7,200 catfish fingerlings.
- n* Leadville to Bozeman, 800,000; to Homer, 200,000; to Spearfish, 1,000,000; to Baird, 50,000; to Saratoga, 500,000; to La Crosse, 100,000 brook trout eggs.
- o* Manchester to Northville, 100,000; to Homer, 101,000 rainbow trout eggs.
- p* Bellevue to Neosho, 3,300 catfish; to San Marcos, 3,625 crappie fingerlings.
- q* North McGregor to San Marcos, 5,900 crappie fingerlings.
- r* Neosho to Quincy, 4,000 rock bass fingerlings; to Erwin, 385,725; to Clackamas, 48,675 rainbow trout eggs.
- s* Northville to Cape Vincent, 9,400,000; to Put in Bay, 2,000,000; to Central Station, 20,000; to Alpena, 4,460,000; to Nashua, 75,000; to Charlevoix, 1,950,000 lake trout eggs.
- t* Charlevoix to Cape Vincent, 1,750,000 lake trout eggs.
- u* Put in Bay to Detroit, 45,680,000; to Duluth, 25,000,000; to Central Station, 1,000,000 whitefish eggs; to Duluth, 17,850,000; to Homer, 10,000,000; to Cape Vincent, 2,000,000; to Central Station, 3,000,000; to Quincy, 3,000,000; to Louisville, 10,000,000 pike perch eggs.
- v* Quinault to Birdsvlew, 225,000 blueback salmon eggs.
- w* Quincy to Tupelo, 375 yellow perch; to San Marcos, 4,000 crappie; to Orangeburg, 340 crappie; 800 catfish; to Cold Springs, 1,500 sunfish fingerlings.
- x* Saratoga to Neosho, 25,200 rainbow trout eggs.
- y* Woods Hole to Gloucester, 5,810,000 cod eggs.
- z* Wytheville to Cold Springs, 7,500 rock bass fingerlings; to Louisville, 25,000; to Manchester, 25,000; to Nashua, 100,000; to St. Johnsbury, 100,000; to Central Station, 20,000; to White Sulphur Springs, 200,000 rainbow trout eggs.

The eggs hatched at the main stations listed in the foregoing table are in many cases obtained from auxiliary sources, usually temporary stations occupied during the season only or, in some instances, mere camps which are shifted from year to year. In the Great Lakes and off the New England coast collections are made by the Bureau's vessels or boats in favorable localities. The following temporary stations and collecting points furnished eggs of the given species for the main hatcheries during 1917.

## LIST OF EGG-COLLECTING STATIONS, FISCAL YEAR 1917.

Station.	Period of operation.	Species handled.
<b>Alaska:</b>		
Seal Harbor.....	June-October.....	Blueback salmon.
Smeaton Bay.....	August-September.....	Do.
Uganak.....	June-October.....	Do.
<b>Colorado:</b>		
Antero Lake.....	April-May.....	Rainbow trout.
Crystal Lake.....	November.....	Brook trout.
Engelbrecht Lakes.....	October-November.....	Do.
Hossellkus Lake.....	do.....	Do.
Musgrove Lakes.....	do.....	Do.
Northfield Lake.....	do.....	Do.
Smith Ponds.....	do.....	Do.
Turquoise Lake.....	do.....	Do.
Uneva Lake.....	do.....	Do.
Woodland Park Lake.....	do.....	Do.
Seven Lakes.....	June.....	Blackspotted trout.
Maine: Portland.....	July-October, May, and June.....	Lobster.
<b>Massachusetts:</b>		
Menemsha.....	January-April.....	Flounder.
Waquoit.....	do.....	Do.
<b>Michigan:</b>		
Bay City.....	April.....	Pike perch.
Bay Port.....	November.....	Whitefish.
Brevort.....	do.....	Do.
Belle Isle.....	October-November.....	Do.
Charity Island.....	do.....	Do.
Cheboygan.....	do.....	Lake trout.
Detour.....	do.....	Do.
Fairport.....	do.....	Do.
Frankfort.....	do.....	Do.
Grand Haven.....	do.....	Do.
Isle Royal.....	do.....	Lake trout and whitefish.
Keystone.....	do.....	Lake trout.
Leland.....	do.....	Lake trout and whitefish.
Manistique.....	do.....	Lake trout.
Marquette.....	do.....	Do.
Monroe.....	April and November.....	Pike perch and whitefish.
Munising.....	October-November.....	Lake trout.
Munoscog.....	April.....	Pike perch.
Naubinway.....	November-December.....	Whitefish.
Northport.....	do.....	Lake trout and whitefish.
Ontonagon.....	October-November.....	Lake trout.
St. Ignace.....	do.....	Do.
St. James.....	do.....	Lake trout and whitefish.
St. Joseph.....	do.....	Lake trout.
Portage.....	do.....	Do.
South Manitou.....	December.....	Whitefish.
Port Lookout.....	do.....	Do.
<b>Minnesota:</b>		
Grand Marais.....	October-December.....	Lake trout and whitefish.
Susie Island.....	November.....	Lake trout.
<b>Montana:</b>		
O'Dell Creek.....	March-May.....	Grayling.
South Meadow Creek.....	do.....	Grayling and rainbow trout.
<b>New York:</b>		
Chaumont.....	November-December.....	Whitefish.
Galloo Island.....	October-November.....	Lake trout.
Grassy Bay.....	May.....	Yellow perch.
Henderson Harbor.....	November-December.....	Lake herring.
Ogdensburg.....	April-May.....	Pike perch.
Pigeon Island.....	October-November.....	Lake trout.
Old Forge.....	November.....	Whitefish.
Sodus Point.....	November-December.....	Lake herring.
South Bay.....	do.....	Whitefish.
Stony Island.....	November.....	Lake trout.
Three Mile Bay.....	November-December.....	Lake herring and whitefish.
Upper Saranac.....	November.....	Whitefish.
<b>Ohio:</b>		
Middle Bass.....	November, December, and April.....	Whitefish and pike perch.
North Bass.....	do.....	Do.
Port Clinton.....	do.....	Do.
Toledo.....	do.....	Do.
Rhode Island: Wickford.....	February-April.....	Flounder.
<b>Vermont:</b>		
Darling Pond.....	July-December.....	Brook trout.
Lake Mitchell.....	September-December.....	Do.
<b>Wyoming:</b>		
Clear Creek.....	July and June.....	Blackspotted trout.
Columbine Creek.....	do.....	Do.
Cub Creek.....	do.....	Do.
Lake Camp.....	do.....	Do.
Pelican Creek.....	do.....	Do.

DISTRIBUTION OF FISH AND EGGS, BY STATES, WATERS, AND SPECIES,  
DURING THE FISCAL YEAR 1917.

On the pages following are shown in detail the distribution of fish eggs, fry, fingerlings, yearlings, and adults, by species, by States and municipalities, alphabetically arranged, and by waters, for the fiscal year ended June 30, 1917.

The distribution was composed largely of fingerlings, yearlings, and adults, though quite a number of eggs and fry of some species were distributed. In succeeding pages where figures are preceded by an asterisk (\*) such numbers indicate an egg distribution; if preceded by a dagger (†), a fry distribution. All other enumerations represent fingerlings, yearlings, and adults.

*Distribution of fish and eggs, fiscal year 1917.*

## CATFISH.

Disposition.	Number.	Disposition.	Number.
Alabama:		Georgia—Continued.	
Abbeville, Davis Mill Pond.....	50	Fayetteville, Coleman's pond.....	100
Birmingham, City Lake.....	40	Gay, Gay's pond.....	20
Dancy, Solesbury Lake.....	200	Williams-Fitzgerald Pond.....	40
Goodwater, Newman's pond.....	100	Loganville, Bennett's pond.....	200
Headland, Blackwood Creek.....	80	Manchester, Rock Creek.....	200
Blue Pond.....	100	Mitchell, Allen's pond.....	100
Brackin's pond.....	140	Monroe, Alcova River.....	300
Dunham Creek.....	80	Roberts's pond.....	200
Montgomery, Sandlin's pond.....	50	Snow's pond.....	200
Pinckard, York's pond.....	100	Piedmont, Bussey Branch.....	100
Three Notch, Miller's pond.....	100	Rochelle, Spring Lake.....	300
Arizona:		Rockmart, Wood-Knight Pond.....	100
Douglas, Mulberry Pond.....	200	Social Circle, Row's pond.....	100
Duncan, Cottonwood Pond.....	200	White Plains, Freestone Pond.....	100
Flagstaff, Lake Mary.....	100	Simmons's pond.....	150
Globe, Roosevelt Lake.....	2,200	Illinois:	
Jerome Junction, Chino Creek.....	100	Apple River, Apple River.....	750
Skull Valley, Otto Pond.....	100	Carbondale, Borger Lake.....	200
Tucson, Soto's pond.....	400	Carrollton, Greenwood Pond.....	200
Arkansas:		Council Hill, Fever River.....	600
Black Rock, Black River.....	15,232	Crystal Lake, Crystal Lake.....	2,000
Daggett, Cache River.....	300	Dallas City, Lake Cooper.....	32
Elkins, Mountain Lake.....	100	Farmer City, Salt Creek.....	200
Fayetteville, White River.....	340	Galena, Mississippi River.....	a 46,500
White River, West Fork.....	400	Galesburg, City Lake.....	200
Green Forest, Pine Grove Pond.....	200	Millington, Fox River.....	600
Harrison, Grassy Pond.....	100	Nora, Apple River.....	1,200
Oak Grove Pond.....	100	North Hanover, Apple River.....	2,000
Kerlin, Christie's pond.....	100	Rodden, Apple River.....	2,000
Mammoth Spring, Warm Fork Creek.....	207	Scales Mound, Fever River.....	600
St. Joe, Johnson's pond.....	40	Stockton, Plum River.....	2,000
Womble, Edwards's pond.....	160	Warren, Apple River.....	1,350
Colorado:		Indiana:	
Cimarron, Swanson Lake.....	200	Angola, Fox Lake.....	200
Fountain, Eureka Lake.....	595	Jackson Lake.....	200
Grand Junction, Welsh Pond.....	495	Edinburgh, Sugar Creek.....	400
Hotchkiss, Park Lake.....	495	Evansville, Evansmere Pond.....	1,000
Montrose, Frees's pond.....	200	Fruitdale, Hillcrest Pond.....	200
Georgia:		Jasonville, Stefanski's pond.....	100
Athens, Brooks's pond.....	200	Mishawaka, St. Joseph River.....	400
Atlanta, Coats's pond.....	40	Muncie, Gravel Pit Pond.....	200
Bogart, Lee's pond.....	100	Iowa:	
Broxton, Kight's pond.....	200	Bellevue, Mississippi River.....	a 344,000
McGovern's pond.....	200	Boone, Des Moines River.....	600
Ricketson's pond.....	100	Fairfield, Fairfield Pond.....	1,250
Carrollton, Little Tallapoosa River.....	300	Fairport, Mississippi River.....	a 112,952
Pittman's pond.....	100	Lime Springs, Upper Iowa River.....	3,750
Crawfordville, Chapman Creek.....	200	Manchester, Maquoketa River.....	3,000
Nuns Pond.....	25	North McGregor, Mississippi River.....	* 531,200
Douglas, Vickers's pond.....	200	Kansas:	
Elberton, Broad River.....	400	Langdon, Sunnybrook Pond.....	150
Fairburn, Reeves's pond.....	100	Osage City, Smith's pond.....	100

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CATFISH—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Kansas—Continued.</b>		<b>Montana:</b>	
Satanta, Irrigation Pond .....	100	Forsyth, Tongue River .....	800
Sharon, Sharon Valley Fruit Farm		Yellowstone River .....	2,000
Lake .....	100	<b>New Hampshire:</b>	
Topeka, Wakarusa River .....	400	Bennington, Gregg Pond .....	600
<b>Kentucky:</b>		Franklin, Pemigewassett River .....	800
Auburn, Fisher's pond .....	100	<b>New Mexico:</b>	
Crofton, Railroad Lake .....	200	Carrizozo, Skow's pond .....	100
Demossville, Licking River .....	300	Chamita, Rio Grande .....	150
Glasgow, Dean's lake .....	200	Deming, Idyl Wyld Pond .....	100
Hodgenville, Nolin Creek .....	600	Elida, McAlester's pond .....	50
Stark's pond .....	100	Mullen's pond .....	50
Lebanon, Mattingly's pond .....	100	Phillips's pond .....	50
Richwood, Denfel's pond .....	100	Kenna, Kimo Pond .....	50
Sturgis, Lindle's pond .....	100	Meirose, Sweet's pond .....	50
Vine Grove, Macey's pond .....	400	Moriarty, Diamond X Ranch Pond .....	100
Riley's pond .....	200	Portales, Dunlap Lake .....	50
<b>Louisiana:</b>		Roswell, Chain Lake .....	100
Lake Charles, King's pond .....	200	Figure Eight Lake .....	50
New Orleans, Aquarium .....	55	Horseshoe Lake .....	100
<b>Maryland:</b>		South Spring River .....	50
Bel Air, Reeves Pond .....	100	Sutherland Lake .....	100
Dickerson, Potomac River .....	125	Roy, Chicosa Lake .....	125
Frederick, Monocacy River .....	400	Socorro, Story's pond .....	50
Seneca, Potomac River .....	150	Torreón Pond .....	50
<b>Massachusetts:</b>		Texico, Jones's pond .....	100
Clinton, Coachlace Pond .....	400	Wagon Mound, Jordan's pond .....	75
East Lake .....	800	Yeso, Willoughby's pond .....	50
Mossy Pond .....	400	<b>New York:</b>	
Wauashacum Lake .....	800	Addison, Canisteo River .....	800
West Lake .....	800	Avon, Horseshoe Pond .....	800
Palmer, State Ponds .....	12,500	Maryland, Schnevus Creek .....	600
<b>Michigan:</b>		Pine Bush, Dwardkill Creek .....	400
Clinton, Raisin River Pond .....	200	Shawangunkkill Creek .....	600
Wampler Lake .....	400	<b>North Carolina:</b>	
Cressey, Crooked Lake .....	400	Elkland, Miller Pond .....	125
Highland, Lakes in Oakland County .....	3,600	Fuquay Springs, Spring Water Pond .....	75
Houghton, O'Neil Lake .....	525	<b>North Dakota:</b> Lisbon, Lone Tree	
Iron Mountain, Crystal Mud Lakes .....	525	Lake .....	1,000
Jackson, Portage Lake .....	400	<b>Ohio:</b>	
Pontiac, Mud Lake .....	200	Belleville, Clear Fork Creek .....	75
St. Louis, Pine River .....	400	Crane Pond .....	25
Scottville, Pere Marquette River .....	400	Cutrow Pond .....	50
Vanderbilt, Round Lake .....	400	Gatton Lake .....	25
<b>Minnesota:</b>		Plank Pond .....	25
Brimson, Indian Lake .....	300	Berea, Kinney Pond .....	400
Currie, Buffalo Lake .....	300	Cincinnati, Lake Como .....	200
Degraff, St. Marys Lake .....	300	Cridersville, Moyer's pond .....	200
Homer, Mississippi River .....	a 548,040	Oneida, Big Sandy Creek .....	600
Lake City, Lake Pepin .....	a 716,772	Robinson, Robinson Pond .....	200
Richmond, Mississippi River .....	a 25,725	St. Marys, Lake St. Marys .....	50
Winona, Mississippi River .....	a 175,900	<b>Oklahoma:</b>	
<b>Mississippi:</b>		Aline, Timmons's pond .....	150
Aberdeen, Cypress Pond .....	200	Altus, City Lake .....	100
Goose Pond .....	200	Armstrong, Hatchery Ponds .....	10
House Pond .....	175	Brinkman, Lake George .....	150
Canton, Farm Lake .....	300	Byars, Hawser Lake .....	200
Ecu, Willow Pond .....	75	Cordell, Barton Pond .....	150
Frars Point, Mississippi River .....	a 3,327	Chamblee Lake .....	150
Hazlehurst, Home Lake .....	300	Edwards Lake .....	150
Kosciusko, Kosciusko Lake .....	100	Davidson, Couch's pond .....	100
West's pond .....	100	Davis, Freeman Lake .....	100
Myrtle, Frazier's pond .....	100	Eldorado, Pleasure Pond .....	100
Pontotoc, Ridgeway Lake .....	150	Erick, Downs Pond .....	150
Tougaloo, Moman's pond .....	40	Fairview, Pail's pond .....	150
Van Vleet, Neal's pond .....	150	Frederick, Slack's pond .....	200
Woodville, Lake Maurice .....	40	Grandfield, Hancock's lake .....	100
<b>Missouri:</b>		Huff's pond .....	100
Cooks, Meramac River .....	800	Parks's pond .....	100
Everton, Oak Leaf Park Pond .....	400	Hobart, Bredel's pond .....	100
Faucett, Moore's pond .....	200	Lakeview Pond .....	100
Jaundon, Graves Lake .....	400	Lenon's pond .....	200
Joplin, Sloan's pond .....	155	Portwood's pond .....	200
La Belle, Lake Mattingly .....	300	Tobin's pond .....	150
Mervin, Corbin's pond .....	400	Jet, Matthews West Lake .....	150
Neosho, Morse Park Ponds .....	300	Twin Lakes .....	150
Springfield, Bray's pond .....	200	Lawton, Highland Lake .....	100
Tebbetts, Elley's pond .....	100	Lookaba, Willow Lake .....	100

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CATFISH—Continued.

Disposition.	Number.	Disposition.	Number.
Oklahoma—Continued.		South Carolina—Continued.	
Mill Creek, Westheimer-Daube Pond	350	Orangeburg, Indogo Run	200
Ringwood, Unruh's pond	100	Sally, Cooper's pond	75
Sulphur, Orchard Hill Pond	150	Sawyer's pond	75
Texhoma, Allison's pond	550	South Dakota:	
Texola, Brushy Creek	150	Bellefourche, Westcott's pond	75
Graves's pond	150	Canton, Sioux River	200
Whorton's pond	150	Fairburn, Fay's pond	75
Thomas, Little Deer Pond	150	Lake Andes, Lake Andes	1,400
Walter, Kennedy's pond	100	Madison, Lake Madison	1,400
Watova, Munson's ponds	100	Pukwana, Red Lake	1,400
Wynnwood, Husted's pond	100	Tennessee:	
Pennsylvania:		Bear Creek Junction, Mining Com-	
Arcola, Perkiomen Creek	170	pany Ponds	70
Cassandra, Noels Creek	300	Bethel Springs, Moore's pond	100
Cherry Tree, Meadow Spring Pond	300	Calhoun, Swofford's pond	70
Coalport, Beaverdam Run	600	Cookeville, Caruthers's pond	70
Collegeville, Perkiomen Creek	170	Denmark, Hardee's pond	100
Curry, Keagy Pond	300	Dyer, Reed's pond	50
Denver, Gross Pond	340	Estill Springs, Elk River	200
Hefts Pond	340	Gleason, Brummitt's pond	50
East Greenville, Perkiomen Creek	170	McKenzie, Sexton's pond	60
Espyville, Spring Run Pond	50	McMinnville, Horton's pond	100
Frankstown, Juniata River	600	Maryville, Boring's pond	100
Gardners Station, Bermudian Creek	300	Murphreesboro, Baskin's pond	85
Latimore Creek	200	Blue Pond	100
Gratersford, Perkiomen Creek	170	Cedar Lake	100
Green Lane, Perkiomen Creek	170	Hoover's pond	75
Hanover, Conewago Creek	200	Nashville, Messenger's pond	200
Hendricks, Perkiomen Creek	170	Ooltewah, Haven's pond	70
Indiana, Moose's pond	600	Quebeck, Davis's pond	70
Johnstown, Wildcat Pond	500	Rutherford, Good Luck Pond	100
Wilmore Pond	500	Springfield, Carr Creek	340
Kratz, Perkiomen Creek	170	Tullahoma, East Mulberry Creek	450
Lancaster, Sheetz's pond	500	Vermont: Lyndonville, State fish com-	
Langhorne, Beechwood Pond	20	mission	100
Gross's pond	250	Virginia: Cullen, Robertson's pond	90
Lititz, Hammer Creek	170	West Virginia:	
Rhudy Run	170	Belington, Viquesney Pond	150
Zartman Pond	340	Elkins, Tygarts Valley River	600
McLean, Perkiomen Creek	170	Harrisville, Hughes River, North	
Mackeyville, Dumm's pond	100	Fork	300
Manheim, Chickies Lake	680	Kerens, Leading Creek	600
Oaks, Perkiomen Creek	170	Keyser, Cabin Run	450
Pennsburg, Perkiomen Creek	170	Powell, Lost Run	600
Pequea, Susquehanna River	850	Weston, West Fork River	300
Perkiomenville, Perkiomen Creek	170	Wisconsin:	
Philadelphia, League Island Pond	100	Eagle River, Eagle Chain of Lakes	6,000
Phoenixville, French Creek	510	Fall Creek, Fall Creek	600
Quakertown, Sheard Lake	250	Fountain City, Mississippi River	a 646,020
Rahns, Perkiomen Creek	170	Genoa, Mississippi River	a 230,000
Red Hill, Perkiomen Creek	170	La Crosse, Mississippi River	a 370,000
Rushland, Neshaminy Creek	550	Ladysmith, Park Lake	300
Salford, Perkiomen Creek	170	Lynxville, Mississippi River	a 200,000
Salisbury Junction, Sullivan Pond	300	Mazomania, Mill Pond	1,200
Schwenksville, Perkiomen Creek	170	Monroe, Hyde Pond	1,200
Scranton, Moosic Lake	200	Monticello, Little Sugar Creek, West	
Somerfield, Marleys Run	300	Branch	900
Souderton, Perkiomen Creek, East		Sugar River, branch of	900
Branch	680	Nashville, Dry Lake	800
Spring Mount, Perkiomen Creek	170	Rice Lake, Berger Lake	300
Stewartstown, Anderson's pond	100	Desair Lake	300
Warrier Ridge, Juniata River	600	Hinrich Lake	300
White Ridge, Juniata River, Franks-		Lake Montanis	300
town Branch	300	Lower Rice Lake	400
Wilkes-Barre, Thorn Lake	350	Moon Lake	300
Yerkes, Perkiomen Creek	170	Spruce Lake	300
Zeiglersville, Perkiomen Creek	170	Tussockia Lake	400
South Carolina:		Trempealeau, Mississippi River	a 154,467
Lowrysville, Robbins's pond (A)	100	Canal Zone: Ancon, Panama Canal	1,000
Robbins's pond (B)	100		
Robbins's pond (C)	100		
Turkey Creek	200		
Lykesland, Gantt's pond	150		

a Rescued from overflowed lands and restored to original waters.

b Lost in transit, 3,955.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CARP.

Disposition.	Number.	Disposition.	Number.
Arkansas: Black Rock, Black River..	6	Mississippi: Friars Point, Mississippi River.....	1,847
Illinois:		Tennessee: Erwin, Bonner's Pond.....	2,000
Dallas, Lake Cooper.....	449	Wisconsin:	
Galena, Mississippi River.....	8,800	Fountain City, Mississippi River....	95,228
Iowa:		Genoa, Mississippi River.....	20,000
Bellevue, Mississippi River.....	33,300	La Crosse, Mississippi River.....	53,000
Fairport, Mississippi River.....	{ †112,000	Lynxville, Mississippi River.....	5,000
Lake City, Lake Pepin.....	4,741	Trempealeau, Mississippi River.....	171,555
North McGregor, Mississippi River..	26,290		
Minnesota:		Total.....	{ †112,000
Homer, Mississippi River.....	122,850		605,407
Lake City, Lake Pepin.....	6,921		
Richmond, Mississippi River.....	23,390		
Winona, Mississippi River.....	30,030		

## BUFFALOFISH.

Arkansas: Black Rock, Black River ..	123	Minnesota—Continued.	
Illinois:		Richmond, Mississippi River.....	17,675
Dallas City, Lake Cooper.....	788	Winona, Mississippi River.....	450
Galena, Mississippi River.....	8,000	Mississippi: Friars Point, Mississippi River.....	3,296
Meredosia, Meredosia Bay.....	150	Missouri:	
New Boston, Mississippi River.....	†1,740,000	Ste. Genevieve, Huber's pond.....	10
Iowa:		Kern's pond.....	10
Bellevue, Mississippi River.....	47,400	Wisconsin:	
Fairport, Mississippi River.....	{ †3,695,000	Fountain City, Mississippi River....	1,150
Muscatine, Mississippi River.....	2,737	Genoa, Mississippi River.....	5,000
North McGregor, Mississippi River..	†100,000	La Crosse, Mississippi River.....	6,500
Port Lawrence, Mississippi River....	55,060	Lynxville, Mississippi River.....	1,000
Quarry Pond, Mississippi River.....	†619,000	Trempealeau, Mississippi River.....	57,450
Sooke Island, Mississippi River.....	†100,000		
Turkey Island, Mississippi River....	†250,000	Total.....	{ †6,754,000
Minnesota:			207,898
Lake City, Lake Pepin.....	1,099		

## SUCKERS.

Arkansas: Black Rock, Black River...	186	Minnesota: Lake City, Lake Pepin....	462
Maryland: Dickerson, Potomac River...	100	Total.....	748

## SHAD.

District of Columbia: Highway Bridge, Potomac River.....	†600,000	Oregon:	
Maryland:		Astoria, Youngs River.....	†180,000
Bar Landing, Potomac River.....	†810,000	Willamette, Willamette River.....	†2,171,000
Broad Creek, Potomac River.....	†7,281,000	South Carolina:	
Chapman Point, Potomac River.....	†1,318,000	Branchville, Edisto River.....	†125,000
Little Hunting Creek, Potomac River.....	†1,853,000	Jacksonboro, Edisto River.....	†145,000
Moxleys Point, Potomac River.....	†7,151,000	Virginia:	
Piscataway Creek, Potomac River....	†8,856,000	Dogue Creek, Potomac River.....	†8,130,000
Swan Creek, Potomac River.....	†7,789,000	Mount Vernon, Potomac River.....	†2,115,000
North Carolina:		Ocoquan Creek, Potomac River.....	†10,315,000
Edenton, Albemarle Sound.....	†5,762,000	Pamunkey Creek, Potomac River....	†5,090,000
Edenton Bay.....	†298,000	Pohick Creek, Potomac River.....	†7,957,000
		Total.....	†77,946,000

## RIVER HERRING.

Disposition.	Number.
Illinois: Galena, Mississippi River.....	177,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## WHITEFISH.

Disposition.	Number.	Disposition.	Number.
Illinois:		Montana: Somers, State fish commis-	
Chicago, Applicant.....	*200,000	sion.....	*300,000
Spring Grove, State fish commission.....	*5,000,000	New York:	
Michigan:		Fox Island, Lake Ontario.....	†750,000
Alpena, Lake Beaver.....	†250,000	Grenadier Island, Lake Ontario.....	†4,850,000
Belle Isle, Detroit River.....	†20,200,000	Hayes Point, Lake Ontario.....	†600,000
Lake St. Clair.....	†10,000,000	Long Lake West, Little Tupper Lake	*500,000
Carsonville, Lake Huron.....	†1,200,000	New York, Aquarium.....	*500,000
Cathead Reef, Lake Michigan.....	†6,000,000	Niagara Falls, Lake Ontario.....	†1,000,000
Crystal Falls, Anderson Lake.....	†100,000	Plattsburg, Lake Champlain.....	†2,000,000
Fortune Lake, North.....	†200,000	Pleasant Lake, Pleasant Lake.....	†500,000
Fortune Lake, South.....	†200,000	Point Peninsula, Lake Ontario.....	†2,750,000
Fort Wayne, Detroit River.....	†5,000,000	Port Henry, Lake Champlain.....	†1,000,000
Iron River, Chicago Lake.....	†300,000	Rouses Point, Lake Champlain.....	†2,000,000
Manistee, Lake Michigan.....	†1,200,000	Three Mile Bay, Lake Ontario.....	†500,000
Manistique, Lake Michigan.....	†1,680,000	Watkins, Seneca Lake.....	†630,000
Manitou Island, Lake Michigan.....	†6,000,000	Wilson, Lake Ontario.....	†3,600,000
Marquette, Lake Superior.....	†3,780,000	Ohio:	
Naubinway, Lake Michigan.....	†2,880,000	Catawba Island, Lake Erie.....	†10,000,000
New Richmond, Lake Michigan.....	†1,200,000	Isle St. George, Lake Erie.....	†40,000,000
Northpoint Reef, Lake Huron.....	†8,000,000	Kellys Island, Lake Erie.....	†35,000,000
Old Mission Point, Traverse Bay.....	†6,000,000	Marblehead, Lake Erie.....	†20,000,000
Point Patterson, Lake Michigan.....	†720,000	Middle Bass, Lake Erie.....	†30,000,000
Point Soul Choix, Lake Michigan.....	†720,000	Port Clinton, Lake Erie.....	†13,500,000
Presque Isle, Grand Lake.....	†300,000	Put In Bay, Lake Erie.....	†35,000,000
Lake Esau.....	†250,000	State fish commission.....	*40,980,000
St. Joseph, Lake Michigan.....	†1,200,000	Sandusky, Lake Erie.....	†10,000,000
Sand Bay, Lake Michigan.....	†6,000,000	Toledo, Lake Erie.....	†15,000,000
Scarecrow Island, Lake Huron.....	†12,000,000	Wisconsin: Sheboygan, State fish	
Susie Island, Lake Superior.....	†1,275,000	commission.....	*5,000,000
Thunder Bay, Lake Huron.....	†5,000,000	Total.....	†52,602,500
Minnesota:			†331,610,000
Grand Portage, Lake Superior.....	†1,275,000		
St. Paul, State fish commission.....	*122,500		

## LAKE HERRING (CISCO).

New York:		New York—Continued.	
Fox Island, Lake Ontario.....	†10,925,000	Three Mile Bay, Lake Ontario.....	†10,500,000
Grenadier Island, Lake Ontario.....	†16,600,000	Tibbetts Point, Lake Ontario.....	†4,000,000
Hardscrabble, Lake Ontario.....	†6,600,000	Trout Hole, Lake Ontario.....	†7,000,000
Hayes Point, Lake Ontario.....	†2,500,000	Wilson Bay, Lake Ontario.....	†12,000,000
Henderson Harbor, Lake Ontario.....	†2,500,000	Total.....	82,550,000
Point Peninsula, Lake Ontario.....	†2,425,000		
Sodus Point, Lake Ontario.....	†7,500,000		

## SILVER SALMON.

California: Hornbrook, Klamath	{	†50,000	Washington—Continued.	
River.....		11,000	Duckabush, Docewallips River.....	1,487,980
Oregon:			Duckabush River.....	{
Applegate, Applegate Creek.....		†393,700		†38,000
Clackamas, Clackamas River.....		4,400		335,980
Trail, Rogue River.....		6,000	Illabott, Illabott Creek.....	†259,600
Troutdale, Big Sandy River.....		10,000	Quilcene, Big Quilcene River.....	137,000
Upper Clackamas, Clackamas River		71,700	Little Quilcene River.....	110,000
Washington:			Quinault, Quinault Lake.....	†1,910,000
Baker Lake, Baker Lake.....		508,900	Sultan, Elwell Creek.....	†340,000
Birdsview, Grandy Creek.....		1,980,000	Skyomish River.....	†515,000
Brinnon, Wolcotts Slough.....		†197,400	Total.....	{
Darrington, Hatchery Creek.....		†700,000		†1,403,700
				4,662,960

## CHINOOK SALMON.

California:		Kentucky: Lexington, Russell Cave	
Baird, McCloud River.....	3,702,000	Spring Lake.....	6,000
Battle Creek, Battle Creek.....	5,695,300	Oregon:	
Hornbrook, Klamath River.....	{	Applegate, Applegate Creek.....	†171,500
	†700,000	Clackamas, Clackamas River.....	3,592,100
	368,000	Hatchery Creek.....	200,000
Klamathon, Klamath River.....	†100,000	Johnson Creek.....	200,000
Mill Creek, Mill Creek.....	4,863,000	Portland, State fish commission.....	*163,900
Sisson, State fish commission.....	*7,027,300		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CHINOOK SALMON—Continued.

Disposition.	Number.	Disposition.	Number.
Oregon—Continued.		Washington—Continued.	
Seuferts, Fifteen Mile Creek.....	60,000	Duckabush, Docewallips River....	689,550
Trail, Rogue River.....	1,758,800	Duckabush River.....	16,957
Upper Clackamas, Clackamas River..	{ 463,000	Illabott, Illabott Creek.....	44,105
	755,200	Little White Salmon, Little White	{ 10,413,365
Washington:		Salmon River.....	4,547,279
Baker Lake, Baker Lake.....	{ 85,581	Quinault, Quinault Lake.....	{ 160,000
Big White Salmon, Big White Sal-	{ 2,437,958		
mon River.....	387,290	Total.....	{ *7,191,200
Spring Creek.....	{ 1,873,000		{ 27,065,581
	180,000		

## BLUEBACK SALMON.

Alaska:		Washington:	
Afgnak, Hatchery Creek.....	{ 7,506,000	Baker Lake, Baker Lake.....	{ 711,825
Lake Creeks.....	{ 2,300,000	Birdsview, Grandy Creek.....	{ 1,996,000
Letnik Lake.....	{ 3,770,700	Grandy Lake.....	60,000
Yes Bay, Hatchery Creek.....	2,200,000	Quinault, Quinault Lake.....	{ 11,150,000
Yes River.....	{ 9,000,000		{ 52,953
Lake McDonald.....	{ 21,200,000		
Yes River.....	{ 1,448,000	Total.....	{ *2,000,000
Oregon: Bonneville, State fish com-	{ 19,400,000		{ 175,038,525
mission.....	*2,000,000		5,793,953

## HUMPBACK SALMON.

Alaska:		Washington:	
Afgnak, Hatchery Creek.....	{ 5,795,000	Birdsview, Grandy Creek.....	{ 165,000
Letnik River.....	{ 13,548,000	Duckabush, Duckabush River....	{ 3,563,810
Maine:		Quilcene, Big Quilcene River....	1,960,120
Calais, St. Croix River.....	4925,050	Little Quilcene River.....	1,700,100
Cherryfield, Narragansett River....	525,000		225,000
Dennysville, Dennys River.....	{ 1,050,000	Total.....	{ 27,406,204
East Machias, East Machias River..	{ 1,050,000		{ 7,449,030
Orland, Orland River.....	{ 1,470,600		
Orono, Penobscot River.....	{ 1,984,339		
South Penobscot, Wights Pond.....	506,500		
Warren, St. Georges River.....	{ 386,715		

## CHUM SALMON.

Washington:		Washington—Continued.	
Birdsview, Grandy Creek.....	928,010	Quilcene, Big Quilcene River.....	{ 6,528,000
Brinnon, Wolcotts Slough.....	{ 892,800	Little Quilcene River.....	{ 1,025,000
Darrington, Bennetts Slough.....	{ 277,000		
Duckabush, Duckabush River.....	{ 2,402,000	Total.....	{ 14,403,300
Illabott, Illabott Creek.....	{ 5,838,520		{ 7,014,580
Little White Salmon, Little White	{ 1,831,000		
Salmon River.....	{ 1,447,500		
	248,050		

## STEELHEAD.

Maine: Forest, Farrar Lake.....	{ 27,200	Minnesota—Continued.	
Massachusetts: Duxbury, Applicant..	{ *200,000	Clearbrook, Deep Lake.....	4,000
Michigan:		Steenerson Lake.....	4,000
Bessemer, Spring Creek.....	2,000	St. Paul, State fish commission....	*260,000
Crystal Falls, Holmes Lake.....	4,000	Tamarack, Sandy Lakes.....	10,000
Paint River.....	4,000	Montana: Forest Grove, Snider's pond.	3,000
Ewen, Ontonagon River.....	4,000	New Hampshire: Conicut, Lake Tarle-	
Ishpeming, Cedar Lake.....	2,000	ton.....	5,500
Skandia, Foster Creek.....	1,500	New Jersey: Hackettstown, State fish	
Watersmeet, Trout Creek.....	4,000	commission.....	*100,000
Minnesota:		New York:	
Brimson, Mollie Lake.....	6,000	Caledonia, State fish commission....	*300,000
Central Lakes, Crystal Lake.....	5,000	Dunraven, State fish commission....	*200,000
Chicago City, Green Lake.....	10,000	North Creek, Thirteenth Lake.....	1,500

\* Loss in transit, 13,335 fry.



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## STEELHEAD—Continued.

Disposition.	Number.	Disposition.	Number.
New York—Continued.		Washington—Continued.	
Oakdale, Great River.....	*100,000	North River.....	8,000
Raquette Lake, Lake Kamso.....	*25,000	Summit Lake.....	6,000
Stamford, Beaver Creek.....	1,500	West Wishkah River.....	8,000
Tuxedo, Tuxedo Lake.....	*25,000	Baker Lake, Baker Lake.....	†66,510
North Dakota: St. John, State fish commission.....	*100,000	Bellingham, Lake Louise.....	5,000
Oregon:		Birdsview, Day Creek.....	15,000
Applegate, Applegate Creek.....	†34,500	Grandy Creek.....	1,075,000
Bonneville, State fish commission.....	*1,037,600	Mill Creek.....	45,000
Butte Falls, State fish commission.....	*650,000	Phinney Creek.....	45,000
Clackamas, Clackamas River.....	286,500	Skagit River.....	198,000
Milk Creek.....	10,000	Brinnon, Docewallips River.....	†235,000
Estacada, Clackamas River.....	40,750	Little Beef Creek.....	†7,800
Mountain Lake, Clackamas River, South Fork.....	1,600	Chewelah, Deer Lake.....	3,500
Trail, Rogue River.....	128,600	Duckabush, Duckabush River.....	†689,700
Vermont:		Kelso, Ostrander Creek, South Fork.....	3,000
Brattleboro, West River.....	2,500	Northport, Deep Lake.....	3,500
Groton, Wells River.....	680	Quilcene, Big Quilcene River.....	†476,500
Holden, Chittenden Pond.....	7,000	Little Quilcene River.....	†150,000
Orleans, Willoughby River.....	3,700	Sand Creek, Sand Creek.....	4,000
Pawlet, Metewee River.....	1,250	Sultan, Elwell Creek.....	†353,500
Roxbury, State fish commission.....	*200,000	Wisconsin:	
Rutland, Button Brook.....	2,000	Cable, Williams Lake.....	4,000
Emerald Lake.....	1,259	Grand View, Aitkins Lake.....	4,000
Scott Brook.....	2,000	Muscalonge Lake.....	4,000
Sunset Lake.....	1,250	Taylor Lake.....	4,000
St. Johnsbury, Joes Pond.....	1,000	Upper Clam Lake.....	6,000
Moose River.....	1,000	Salmo, Raspberry Creek.....	4,000
Sleepers River.....	3,000	Sioux River.....	5,000
South Royalton, White River, branch of.....	6,000	Waupaca, Little Wolf River, South Branch.....	10,000
South Ryegate, Round Pond.....	2,000	Wyoming:	
Waterbury, Waterbury River.....	6,120	Laramie, State fish commission.....	*100,000
Washington:		North Platte, North Platte River.....	9,500
Aberdeen, East Wishkah River.....	6,000		
Newskah River.....	6,000	Total.....	{ *3,237,600 †2,040,710 2,061,709

## RAINBOW TROUT.

Alabama: Chandler Springs, Chandler Springs Creek.....	600	Colorado—Continued.	
Arkansas:		Norrie, Deeds Creek.....	2,000
Harrison, Mill Creek.....	2,500	Ophir, Howard Fork Lake.....	1,000
Lewisville, Dobson's pond.....	172	Ouray, Blue Lake.....	1,500
California:		Lake Lenore.....	1,000
Baird, McCloud River.....	14,450	Parshall, Keyser Creek.....	2,000
Hornbrook, Klamath River.....	†11,200	Riffe, White River.....	2,000
Point Reyes, Lime Gulch Creek.....	†25,000	White River, South Fork.....	1,500
Colorado:		Rosemont, Abbott's pond.....	500
Almont, East River.....	1,500	Ruedi, Ford and Henderson Lake.....	4,000
Antero, Antero Reservoir.....	52,500	Frying Pan River.....	4,000
Austin, Surface Creek, West Fork.....	1,000	Ruedi Creek.....	2,000
Bowie, Hubbard Creek.....	2,000	Ruedi Lake.....	4,000
Castles, Taylor Creek.....	2,000	Smith Creek.....	2,000
Debeque, Leon Creek.....	2,000	Salida, Cochetopa Creek.....	1,000
Mesa Lake.....	5,000	South Arkansas River.....	1,500
Delta, Surface Creek.....	4,000	Sapinero, Gunnison River.....	1,500
Durango, Conejos River.....	1,500	Sellar, Cunningham Creek.....	1,000
Potato Lake.....	1,500	Sloss, Frying Pan River.....	4,000
Estes Park, Big Thompson River, South Fork.....	15,000	Rocky Fork Creek.....	2,000
Florissant, Crystal Peak Pond.....	500	Steamboat Springs, Walton Creek Pond.....	500
Fraser, Little St. Louis Creek.....	500	Vasquez, Little Vasquez Creek.....	500
Granby, Beaver Lake.....	2,000	Walden, Michigan River.....	10,000
Grand Lake.....	2,000	North Platte River.....	10,000
Hillside, Angico Pond.....	2,500	Weston, Russell Lake.....	6,000
Leadville, Lower Evergreen Lake.....	6,000	Connecticut: Taconic, Ward Brook.....	1,007
Loveland, Big Thompson River.....	11,000	Georgia:	
Big Thompson River, North Fork.....	19,000	Asbestos, Merritt Creek.....	2,000
Big Thompson River, South Fork.....	21,000	Blue Ridge, Big Rock Creek.....	1,600
Platte River, Millers Fork.....	8,000	Big Skeenah Creek.....	1,600
Matterhorn, Priest Lakes, Lutz's pond.....	1,000	Cooper Creek.....	1,200
Moffat, Lutz's pond.....	500	Fightingtown Creek.....	800
		Nootootla Creek.....	1,600
		Toccoa River.....	1,200

a Lost in transit, 3,500 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Georgia—Continued.</b>		<b>Minnesota:</b>	
Cartersville, Allatoona Creek.....	1, 200	Caledonia, Badger Creek.....	500
Raccoon Creek.....	500	Crooked Creek.....	500
Stamp Creek.....	1, 200	East Beaver Creek.....	500
Cleveland, Cathy Creek.....	6, 000	Irish Creek.....	500
Chocoy Creek.....	5, 000	Minneapolis, Nine Mile Creek.....	2, 500
Shoal Creek.....	4, 000	St. Paul Park, Okoboji Lake.....	1, 000
Helen, Mitchell's Lake.....	1, 000	Winona, Ginters Creek.....	600
Hiawassee, Swallow Creek.....	6, 000	Stockton Creek.....	600
Robertstown, Briar Creek.....	2, 000	Mississippi: Pachuta, Horse Shoe Pond.....	1, 800
Fodder Creek.....	5, 000	Missouri:	
Soapstone Creek.....	3, 000	Browns Spring, Spring Creek.....	300
Tiger, Hitower Creek.....	3, 000	Cabool, Big Piney River, Upper.....	250
<b>Idaho:</b>		Exeter, Flat Creek.....	600
Albany Falls, Vane Lakes.....	1, 600	Roaring River.....	2, 600
Bellevue, Spring Creek.....	5, 000	Fairview, Barber Lake.....	1, 235
Boise, Big Spring Creek.....	7, 500	Joplin, Jenkins Creek.....	2, 500
Blackfoot River.....	15, 000	Lebanon, Bennett Spring River.....	91
Buffalo Creek.....	10, 000	Ha Ha Tonka Lake.....	250
Lost River.....	18, 750	Neosho, Hickory Creek.....	8, 090
Wood River.....	18, 750	Newburg, Kaintuck Creek.....	5, 000
Lakeport, Payette River.....	20, 000	Noel, Elk River.....	4, 000
Spirit Lake, Spirit Lake.....	12, 800	Northview, Pomme de Terre River.....	300
<b>Illinois:</b>		Turn-bull Creek.....	300
Cary Station, Highland Creek.....	1, 000	Pineville, Little Sugar Creek.....	3, 600
Chicago, Applicant.....	*2, 000	Rolla, Little Piney River.....	9, 000
Spring Grove, State fish commission.....	*50, 000	St. James, Meramec Spring Pond.....	4, 125
Indiana: Warsaw, McKrill's pond.....	3, 000	North Meramec River.....	150
<b>Iowa:</b>		St. Joseph, State fish commission.....	*98, 400
Cedar Rapids, Coe College.....	*2, 000	Steelville, Dry Creek.....	75
Harts Ranch Siding, Little Paint Creek.....	1, 000	Verona, Spring River.....	8, 000
Paint Creek.....	2, 000	Wayne, Eden's pond.....	2, 500
Jackson Junction, Goddard Creek.....	2, 000	<b>Montana:</b>	
Manchester, Head of Spring Branch.....	1, 500	Anaconda, State fish commission.....	†153, 000
Monona, Willow Lake.....	1, 000	Arlee, Jocko River.....	3, 750
North McGregor, Bloody Run.....	2, 000	Valley Creek.....	3, 750
Douseman, Coulee Creek.....	2, 500	Belgrade, Bull Run.....	6, 000
Sioux City, Spring Valley Creek.....	1, 000	Cottonwood Creek.....	8, 000
Waterville, Paint Creek.....	2, 500	Dry Creek.....	3, 000
<b>Kentucky:</b>		East Gallatin River.....	3, 000
Dione, Kentucky River, Poor Fork.....	1, 560	Middle Creek.....	3, 000
Gatun, Kentucky River, Clover Fork.....	1, 650	Pass Creek.....	3, 000
Harlan, Kentucky River, Martin Fork.....	1, 650	Reese Creek.....	3, 000
Jeffersontown, Osterholt's pond.....	1, 000	Ross Creek.....	3, 000
Livingston, Sinking Creek.....	660	Sixteen Mile Creek.....	3, 000
Nubert, Kentucky River, Clover Fork.....	1, 330	Thompson Creek.....	3, 000
Pineville, Kentucky River, Clear Fork.....	1, 650	West Gallatin River.....	3, 000
Rhea, Kentucky River, Poor Fork.....	1, 500	Billings, Spring Creek.....	7, 500
<b>Maine:</b>		Box Elder, Cowan's pond.....	3, 750
Farmington, Clearwater Lake.....	4, 000	Boyd, Red Lodge Creek.....	6, 000
Portland, Crooked River.....	4, 000	Bozeman, Brackett Creek.....	2, 500
<b>Maryland:</b>		Bridger Creek.....	2, 500
Baltimore, Applicant.....	*6, 800	Buck Creek.....	2, 000
Deer Park, Altamont Lake.....	600	Cache Creek.....	2, 000
Frostburg, School House Run.....	300	Cherry Creek.....	2, 000
Hagerstown, City Park Lake.....	2, 000	Fransham Creek.....	2, 000
Oakland, Cherry Creek.....	300	Lava Lake.....	25, 000
Deep Creek.....	300	Meadow Creek.....	2, 000
Dunkard Lick Run.....	300	Middle Creek.....	13, 000
<b>Massachusetts:</b>		Mystic Lake.....	2, 000
Athol, Swift River, East Branch.....	3, 000	North Twin Lake.....	2, 000
Leominster, Wickeepeekee Vrook.....	3, 000	O'Dell Creek.....	2, 000
Lowell, Burgess Pond.....	2, 000	Ole Olson Lake.....	2, 000
Forge Pond.....	3, 000	Pass Creek.....	2, 000
Long Pond.....	3, 000	Pine Creek.....	2, 000
Long-Sought-For Pond.....	2, 000	Rocky Creek.....	2, 500
Spectacle Pond.....	3, 000	Sage Creek.....	2, 500
<b>Michigan:</b>		Sales Lake.....	2, 500
Branch, Pere Marquette River.....	6, 000	Sixteen Mile Creek.....	3, 000
Metamore, Brandts Creek.....	†6, 000	South Taylor Creek.....	2, 000
Montrose, Glenn Lake.....	†3, 000	South Twin Lake.....	2, 000
Mount Pleasant, Chippewa River.....	†6, 000	Story Lake.....	2, 000
Owosso, Applicant.....	*180, 000	Taylor Creek.....	3, 000
Maple River Branch.....	†3, 000	West Rainbow Lake.....	2, 400
Wingleton, Pere Marquette River.....	6, 000	Browning, Arnoux Creek.....	2, 000
		Cut Bank Creek, North Fork.....	4, 000
		Cut Bank Creek, South Fork.....	1, 000
		Elk Creek.....	2, 000
		Flat Iron Creek.....	2, 000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Montana—Continued.		New Mexico:	
Browning—Continued.		Chama, Chama River.....	1,000
Greasewood Creek.....	2,000	Chamita, Santa Clara Creek.....	1,000
Livermore Creek.....	2,000	Cloviss, Taylors pond.....	500
Milk River, Middle Fork.....	2,000	Costilla, Costilla Creek.....	1,500
Milk River, South Fork.....	2,000	Embudo, Penasco Creek.....	1,000
Willow Creek.....	2,000	Glorieta, Stewart Lake.....	500
Bynum, Farmers Lake.....	10,000	Las Vegas, Calf Canyon Run.....	500
Cascade, Lake Thirty Five.....	14,000	South Fork Gallinas River, branch	
Dell, Basin Creek.....	12,500	of.....	500
Sage Creek.....	18,750	Park Spring Lake.....	500
Dillon, Best's pond.....	2,000	Rio de La Casa.....	500
Edgar, Pryor Creek.....	8,000	Santa Fe, Tesuque River.....	1,000
Forest Grove, Flat Willow Creek,		Taos, Ben Hur Lake.....	500
South Fork.....	2,000	Wagon Mound, Spring Canon Creek.....	500
McCartney Creek.....	2,000	New York:	
Glacier Park, Gunsight Lake.....	30,000	Auburn, North Brook.....	13,000
Great Falls, Elk Run Creek.....	16,000	Owasco Lake.....	16,000
Hilger, Moccasin Creek.....	2,000	Sennet Brook.....	14,000
Lewistown, Casino Creek.....	3,000	Benson Mines, Star Lake.....	18,000
Libby, Parmenter Creek.....	8,000	Twin Lakes.....	15,000
Malta, Beaver Creek.....	3,750	Forestport, Little Woodhull Creek.....	18,000
Manhattan, Camp Creek.....	6,000	Gouverneur, Silvia Lake.....	14,000
Gibson Creek.....	4,000	Great Bend, Black Creek.....	18,000
Oyer Creek.....	4,000	Hornell, Canacadea Creek.....	18,000
Martindale, Trail Creek.....	4,000	Canisteo Creek.....	13,000
Missoula, Belmont Creek.....	6,250	Lafargeville, Catfish Creek.....	14,000
Big Blackfoot River.....	8,750	Newton Falls, Grasse River.....	18,000
Clearwater River.....	12,500	New York City, Aquarium.....	*5,000
Deer Creek.....	6,250	Port Jervis, Shinglekill Creek.....	16,000
Elbow Lake.....	8,750	Syracuse, Butternut Creek.....	18,000
Gold Creek.....	8,750	Limestone Creek.....	14,000
Lake Inez.....	6,250	Nine Mile Creek.....	14,000
Placid Lake.....	8,750	North Carolina:	
Salmon Lake.....	10,000	Black Mountain, Long Branch.....	4,000
Seelye Lake.....	8,750	Swannanoa River, North Fork.....	10,000
Monida, Picnic Springs Pond.....	3,000	Swannanoa River, Sugar Fork.....	4,000
Moccasin, Louise Creek.....	14,000	Bowie, Pine Swamp Creek.....	3,000
Plains, Kelly Lake.....	7,500	Brevard, Kings Creek.....	5,000
Red Lodge, Rosebud River.....	27,000	Cherryfield, Cherryfield Creek.....	5,000
Stevensville, Bitter Root River,		Darby, Buffalo Creek, Joes Fork.....	2,100
Burnt Fork.....	12,000	Dugger Creek.....	2,100
Kootenai Creek.....	18,000	Laurel Creek.....	1,400
North Burnt Fork Creek.....	5,000	Laurel Creek, Flannery Fork.....	2,100
Smith Slough Creek.....	2,500	Little Dugger Creek.....	1,400
Spring Creek.....	14,000	Pegs Branch.....	1,400
Swamp Creek.....	16,000	Rock House Creek.....	1,400
Sweet Grass, Maverick Lake.....	5,000	Upper Buffalo Creek.....	2,800
Townsend, Deep Creek.....	5,000	Upper Elk Creek.....	2,500
Whitefish, Beaver Lake.....	8,000	Yadkin River, Upper Stony Fork.....	2,100
Whitefish Lake.....	9,600	Denny, Bobs Branch.....	1,400
Yellowstone, Madison River, South		Doughton, Sandy Creek.....	1,400
Fork.....	30,000	Elkin, Flat Creek.....	2,100
Nebraska:		Mitchells River, South Fork.....	2,800
Kilgore, Spring Creek.....	2,000	Wood Creek.....	2,100
Lakeside, Tyler's pond.....	3,000	Elkland, Elk Creek.....	2,000
Rushville, American Horse Creek.....	2,000	Little Elk Creek.....	2,000
Medicine Root Creek.....	2,000	New River.....	5,000
No Flesh Creek.....	2,000	Elkville, Ready Branch.....	1,400
Pine Creek.....	2,000	Forney, Forney Creek.....	12,000
White Clay Creek.....	2,000	Hendersonville, Hickory Creek.....	1,400
Nevada:		Mill Creek.....	1,400
Ely, Applicant.....	*90,000	Punchan Camp Creek.....	1,400
Verdi, Truckee River and tributa-		Hickory, Mountain Creek.....	1,400
ries.....	3,000	Highlands, Adams pond.....	2,000
New Hampshire:		Hot Springs, Little Creek.....	4,000
Bennington, North Branch River.....	5,000	Huntdale, Big Creek.....	700
Campton, Ellsworth Pond.....	3,000	Lynville, Lynville River.....	58,000
Enfield, Cole Pond.....	3,000	Watauga River.....	16,000
Keene, Ashuelot River.....	4,000	McNeil, Masters Branch.....	1,400
Meredith, Lake Winnepesaukee.....	19,000	Vanda Creek.....	1,400
Newport, Sugar River, North		Marion, Buck Creek.....	15,000
branch.....	3,000	South Toe River.....	10,000
Sugar River, South Branch.....	3,000	Marley Ford, Yadkin River, South	
Potter Place, Cole Pond.....	6,000	Lewis Fork.....	2,100
Warren, State fish commission.....	*100,000	Yadkin River, Stony Fork.....	2,800
New Jersey:		Montezuma, Chestnut Heights Lake.....	3,000
Englewood, East Northvale Brook..	400	Mortimer, Crooked Creek.....	2,100
Hackettstown, State fish commission	*50,000	Newland, Kentucky Creek.....	6,000
Whippany, Bagdley Brook.....	800	Toe River.....	10,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
North Carolina—Continued.		Pennsylvania—Continued.	
Noland, Noland Creek.....	8,000	Coudersport, Healks Run.....	1,000
North Wilkesboro, Halls Creek.....	2,100	Howland Creek.....	1,000
Mulberry Creek.....	1,400	Indian Run.....	1,500
Old Fort, Catawba River, North Fork.....	750	Jones Run.....	1,500
Pineola, Linville River.....	1,040	Leit Run.....	1,000
Upper Creek.....	1,875	Lent Run.....	1,000
Pisgah Forest, Davidson River and tributaries.....	8,000	Lent Hollow Run.....	1,500
Selica, Cathey Creek.....	6,000	Niles Run.....	1,000
Sevier, Crab Tree Creek.....	10,000	Pattens Run.....	1,000
Shulls Mills, Watauga River.....	28,000	Ruse Branch.....	1,000
Thurmond, White Oak Creek.....	2,800	Seibert Run.....	1,000
Royal City Creek.....	1,400	Sherwood Creek.....	1,000
Tuxedo, Green River.....	2,100	Sinking Branch.....	1,500
Rock Creek.....	1,400	Spoore Run.....	1,000
Ohio:		Stone Run.....	1,000
Bellefontaine, Mad River, Headwaters.....	†6,000	Toles Hollow Run.....	1,000
Rush Creek.....	†6,000	Williams Run.....	1,000
Oklahoma:		Wolf Run.....	1,000
Ada, Byrds Mill Creek.....	300	Doylestown, Mountain Run.....	2,400
Crescent, Kellys Lake.....	100	Tinicum Creek.....	2,400
Oregon:		Dudley, Trough Creek.....	2,500
Lakeside, Eel Lake.....	5,000	East Mahoney, Lakewood Lake.....	1,000
Ten Mile Lake.....	5,000	Easton, Bushkill Creek.....	4,000
Pennsylvania:		Ebensburg, Davis Creek.....	1,800
Altoona, Canoe Run.....	15,000	Pryce Creek.....	1,800
Piney Creek.....	21,600	Everett, Oregon Creek.....	4,200
Sinking Run.....	19,600	Fairview, Lent Woods Creek.....	2,000
Vanscoyver Run.....	15,000	Forks, Fishing Creek.....	2,500
Aspinwall, Hickory Spring Lake.....	1,400	Garden, Trout Creek.....	1,500
Bellwood, Bells Gap Creek.....	1,800	Valley Creek.....	1,500
Logan Spring Lake.....	1,200	Gardner, Gardner Creek.....	2,250
Sandy Run.....	1,800	Hellertown, Saucon Creek.....	1,500
Tipton Run.....	1,800	Hollidaysburg, Cave Run.....	1,200
Bridgeport, Crow Creek.....	1,500	Howellville, Valley Creek and branches.....	6,000
Carlisle, School Farm Pond.....	1,000	Hughesville, Big Muncy Creek.....	3,000
Chambersburg, Caledonia Creek.....	5,500	Little Muncy Creek.....	3,000
Falling Spring Run.....	17,825	Muncy Creek.....	3,000
Poor House Run.....	4,250	Johnstown, Alwine Run.....	1,400
Sanatorium Lake.....	425	Baker Run.....	1,400
Clearfield, Albert Run.....	1,000	Beaver Run (A).....	1,400
Alder Run.....	1,000	Beaver Run (B).....	1,400
Bald Hill Run.....	1,000	Bens Creek.....	1,400
Barger Run.....	1,000	Bens Creek, North Fork.....	1,400
Coal Run.....	1,000	Bens Creek, South Fork.....	1,400
Cold Run.....	1,000	Big Spring Run.....	1,400
Cowder Run.....	1,000	Breast Work Run.....	1,400
Cyphers Run.....	1,000	Canfield Run.....	1,400
Dixon Run.....	1,000	Daily Draft Creek.....	1,400
Graffins Run.....	1,000	Dalton Run.....	1,400
Green Run.....	1,000	Dalton Run, Left Fork.....	1,400
Gufford Run.....	1,000	Hinckston Run.....	1,400
Hoover Run.....	1,000	Hinckston Run, Right Fork.....	700
Knepp Run.....	1,000	Laurel Run (A).....	1,400
Krise Run.....	1,000	Laurel Run (B).....	1,400
Leonard Run.....	1,000	Laurel Run, Left Fork.....	1,400
Little Moravian Creek.....	1,000	Lick Run.....	1,400
Little Trout Run.....	1,000	Linhart Run.....	1,400
Little Trout Run, left-hand branch.....	1,000	Little Mill Creek (A).....	1,400
Livingston Run.....	1,000	Little Mill Creek (B).....	1,400
Lost Run.....	1,000	Mill Creek (A).....	1,400
Moravian Run.....	1,000	Mill Creek (B).....	1,400
Mosquito Creek.....	1,000	Mill Creek, Left Fork (A).....	1,400
Pine Hollow Run.....	1,000	Miller Run.....	1,400
Rock Hollow Run.....	1,000	Mishler Run.....	1,400
Sanders Big Run.....	1,000	O'Connor Run.....	1,400
Sanders Run.....	1,000	Powder Mill Run.....	1,400
Spruce Run.....	1,000	Rachels Run.....	1,400
Still House Run.....	1,000	Red Run.....	1,400
Urey Run.....	1,000	Salt Lick Creek.....	1,400
Wolf Run.....	1,000	Salt Lick Creek, Right Fork.....	700
Woodland Run.....	1,000	Shingle Run.....	1,400
Zerfoss Run.....	1,000	Solomons Run.....	1,400
Coudersport, Colcord Creek.....	1,000	Solomons Run, Right Fork.....	1,400
Fees Run.....	1,000	Sugar Run.....	1,400
Fenner Branch.....	1,000	Sugar Run Pond.....	1,400
Green Run.....	1,500	Sugar Run Pond, Lower.....	700
		Tub Mill Creek.....	1,400
		Wildcat Run.....	1,400

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		South Dakota—Continued.	
King of Prussia, Trout Creek and branches.....	1,500	Mystic, Castle Creek.....	2,000
Knoxville, King's pond.....	500	Nahant, Hop Creek.....	1,000
Littitz, Poplar Run, West Branch.....	2,250	Little Rapid Creek.....	1,000
Media, Ridley Creek.....	2,000	Middle Box Elder Creek.....	2,000
Nanty Glo, Evans Run.....	1,200	Nigger Creek.....	1,000
Mary Powell Run.....	1,200	Rapid Creek.....	1,000
New Centerville, Crow Creek.....	1,000	Rapid Creek, North Branch.....	1,000
Gulph Creek and branches.....	2,000	Newell, Phillips's pond.....	2,000
Trout Creek and branches.....	1,500	Piedmont, Big Elk Creek.....	3,000
Valley Creek and branches.....	2,500	Rapid City, Barker's pond.....	11,000
Newport, Hunters Valley Creek.....	3,000	Boegel Pond.....	2,000
Northbrook, Glen Hall Creek.....	2,100	Mahoney's pond.....	11,000
Oil City, Camp 23 Run.....	2,000	Minnelusa Creek.....	1,000
Paoli Road, Trout Creek and branches.....	1,500	Rapid Creek.....	11,000
Valley Creek and branches.....	4,500	Rochford, Castle Creek.....	1,000
Planebrook, Crook Creek.....	1,500	Riley Pond.....	1,000
Trout Creek and branches.....	1,500	Savoy, Breakneck Gulch Run.....	13,000
Pleasant Mount, State fish commission.....	*50,000	Little Spearfish Creek.....	18,000
Richland, Bennet Lake.....	500	Spearfish Creek.....	14,000
Krumstown Creek.....	500	Spearfish, Boyden Spring Branch.....	11,000
Mill Creek.....	500	Crow Creek, Upper Branch.....	11,000
Millard Lake.....	500	Hulls Creek.....	11,000
Stricklerstown Creek.....	500	La Plant Creek.....	11,000
St. Clair, Silver Creek Pond.....	2,000	Nicholls's pond.....	11,000
Smithfield, Sandy Creek.....	2,800	Nicholls Spring Branch.....	1,000
Somerfield, Laurel Run.....	2,800	Niva's pond.....	1,000
Strattonville, Zagst's pond.....	2,000	Pierce Lake.....	11,000
Tamaqua, Cramers Run.....	1,000	Ranch Creek.....	11,000
Toby Run.....	1,000	Redwater Power Canal.....	11,000
Troy, Leonard Creek.....	3,000	Robinson Lake.....	1,000
Tryonville, Olson's pond.....	3,000	Sand Creek.....	3,000
Uniontown, Seaton's lake.....	2,100	Schmidt Creek.....	11,000
Warfordsburg, Green Valley Pond.....	700	Spearfish Creek.....	15,000
Waynesboro, East Antietam Creek.....	6,000	Spring Branch.....	11,000
Red Run.....	3,000	Swamp Creek.....	11,000
West Chester, Valley Creek.....	3,000	Sturgis, Bear Butte Creek.....	12,000
Williamsport, Loyalsock Creek.....	4,000	Spring Creek.....	1,000
Windber, Dark Shade Creek.....	1,800	Tilford, Morse Pond.....	1,000
South Carolina:		Tennessee:	
Mount Croghan, Short's pond.....	1,000	Browns, Laurel Creek.....	1,600
Pickens, Little Mountain Creek.....	3,000	Chattanooga, Rainbow Lake.....	500
Mountain Creek.....	3,000	Stanley Creek.....	725
Rock Laurel Creek.....	2,000	Elkmont, Bear Wallow Creek.....	1,600
Thompson River.....	3,000	Jakes Creek.....	5,600
Whitewater River.....	4,000	Little River.....	4,400
Walhalla, Chattooga River, East Branch.....	4,800	Little River, East Prong.....	3,000
Devils Fork Creek.....	4,000	Little River, West Prong.....	2,000
Devils Fork Creek, East Branch.....	3,200	Pigeon River.....	2,000
Devils Fork Creek, West Branch.....	4,000	Erwin, North Indian Creek.....	612
Indian Camp Creek.....	4,000	Spring Branch.....	2,425
Moody Creek.....	3,200	Fanner, Coker Creek.....	800
Whitewater River.....	8,000	Huntland, Reynolds Lake.....	600
South Dakota:		Johnson City, Sinking Creek.....	1,400
Brennan, Wounded Knee Creek.....	2,000	Jonesboro, Broyles Creek.....	2,000
Buffalo Gap, Beaver Creek.....	7,000	McFarland, Coca Creek.....	800
Black Tail Run.....	1,000	Newport, Sinking Creek.....	975
Elmore, Spearfish Creek.....	12,000	Noeton, Holston River.....	1,600
Englewood, Bogus Jum Creek.....	6,000	Probst, Lost Creek.....	800
Box Elder Creek.....	4,000	Roan Mountain, Heaton Creek.....	6,000
Elk Creek.....	12,000	Shell Creek.....	10,000
Hay Creek.....	11,000	Wonderland Park, Laurel Creek.....	1,800
Landis Creek, Southeast Fork.....	1,000	Little River.....	2,000
Peak Creek, South Branch.....	1,000	Utah:	
South Branch.....	11,000	Provo, Strong's pond.....	1,000
Spearfish Creek, South Branch.....	1,000	Salt Lake City, Bowen's pond.....	500
Upper Lake.....	11,000	Byde-A-Wyle Ponds.....	500
Fairburn, Dry Creek.....	1,000	Vermont:	
French Creek.....	2,000	Marshfield, Winooski River.....	2,000
Hill City, Spring Creek.....	4,000	Newport, Clyde River.....	1,000
Hot Springs, Cascade Creek.....	2,600	North Troy, Mississiquoi River.....	1,000
Wind Cave Creek.....	1,000	Virginia:	
Maple River, Maple River.....	2,000	Abingdon, White Top Creek.....	47,000
Midland, Standford's pond.....	1,000	Alleghany, Dunlaps Creek, Headwaters.....	3,000
Mitchell, Enemy Creek.....	3,000	Arcadia, McFalls Creek.....	3,200
		Atkins, Holston River, Middle Fork.....	8,000
		Nicks Creek.....	2,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Virginia—Continued.		West Virginia:	
Bedford, Otter River, Hales Fork.....	2,400	Alexander, Bear Camp Run.....	600
Otter River, North Fork.....	1,200	Buckhannon River.....	1,200
Betty Baker, Burks Fork Creek.....	4,800	Buckhannon River, Middle Fork.....	600
Blacksburg, Mill Creek.....	1,800	Elk River, North Fork.....	600
Blue Ridge, Clark's pond.....	600	Lick Run.....	300
Buchanan, Stoney Run.....	3,200	Bowden, Cheat River, Shavers Fork.....	1,200
Catawba, Catawba Creek.....	2,400	Caldwell, Monroe Draft Creek.....	5,000
Catawba Creek, North Branch.....	2,000	Clover Lick, Clover Creek.....	1,200
Christiansburg, Elliotts Creek.....	2,000	Dobbin, Stony River Lake.....	875
Lawrence Pond.....	800	Edinburg, Trout Run.....	3,000
Stony Creek.....	800	Elkins, Tygarts Valley River.....	1,000
Struples Creek.....	1,200	Glady, Cheat River, Glady Fork.....	2,100
Wilson Creek.....	1,200	Green Spring, Jenkins Pond.....	100
Damascus, Beaverdam Creek.....	10,000	Harman, Big Run.....	900
Birch Branch.....	2,000	Briery Run.....	600
Tennessee Laurel Creek.....	10,000	Dice Run.....	900
White Top Laurel Creek.....	10,000	Laurel Run.....	1,200
Delvale, Powells River, North Fork.....	4,200	Keyser, Mill Run.....	600
Dolphin, Abernathy's pond.....	600	Martinsburg, Tuscarora Creek.....	1,200
Dryden, Ridge View Pond.....	2,000	Midvale, Long Run.....	16,625
East Radford, Conley Creek.....	1,200	Parkersburg, Bailey's pond.....	300
Meadow Creek.....	1,800	Raleigh, Glade Creek.....	800
Ellett, Lester Creek.....	1,800	Richwood, Cherry River, South Fork.....	1,400
Fairwood, Fox Creek.....	3,000	Thomas, Blackwater River, North Fork.....	600
Wilson Creek.....	1,500	Walkerville, Little Kanawha River.....	1,200
Fagg, Big Trap Run.....	1,800	Wisconsin:	
Keney Run.....	1,200	Aniwa, Carpenter Creek.....	500
Fries Junction, Brushy Creek.....	8,000	O'Neil Creek.....	500
Goodview, Jumping Run.....	3,600	Red River.....	500
Hardwood, Hayes Creek.....	1,000	Arcadia, American Valley Creek.....	1,500
Harriston, Moorman River.....	3,000	Davis Creek.....	1,500
Keezleton, Cub Run.....	2,000	Glencoe Creek.....	1,000
Mountain Run.....	3,000	Lewis Valley Creek.....	1,500
Kimballton, Big Stony Creek.....	6,000	North Creek.....	1,000
Lexington, Big Spring Pond.....	2,100	Rock Creek.....	2,500
Lynchburg, Buffalo Creek.....	1,600	Smith Creek.....	1,500
Meadow View, Moore Creek.....	3,250	Athelstane, Big Eagle Creek.....	1,500
Narrows, Mill Creek.....	2,000	Bangor, Johnson Creek.....	1,000
New Castle, Meadow Creek.....	1,600	Birmingham, Embarras River, and tributaries.....	1,800
Pembroke, Little Stony Creek.....	3,000	Blair, Trump Cooley Creek.....	1,500
Pulaski, Thorn Pond.....	1,200	Bloomer, Duncan Creek.....	3,000
Purcell, Jones Creek.....	3,000	Blue Mounds, Handels Run.....	2,000
Powells River, North Fork.....	4,000	Ryans Run.....	1,500
Richmond, Blithewood Pond.....	600	Walnut Hollow Run.....	2,000
Roanoke, Meadow Creek.....	1,200	Boscobel, Sanders Creek.....	2,000
Smith Creek.....	1,000	Deer Park, Willow River.....	2,000
Rural Retreat, Cripple Creek.....	4,000	Elkhorn, Whitewater Creek.....	1,500
Shawsville, Anderson Run.....	1,050	Ellis Junction, Hand Saw Creek.....	1,500
Vaughan Creek.....	6,000	Fairchild, Black Creek.....	1,000
White House Creek.....	600	Beaver Creek.....	1,000
Shenandoah, Cub Run.....	6,000	Flick Creek.....	500
Snowden, Dancing Creek.....	2,800	Hay Creek, East.....	1,000
Otter Creek.....	2,800	Horse Creek.....	500
Staunton, Mill Creek.....	2,000	Pea Creek.....	1,000
Stephenson, Turkey Run.....	1,050	Pettis Creek.....	500
Sylvatus, Green Creek.....	1,400	Scott Creek.....	500
Laurel Fork Creek.....	2,800	Thompson Creek.....	500
Tazewell, Beaver's pond.....	500	Yahn Creek.....	500
Wolf Creek.....	6,000	Fond du Lac, Dotyville Creek.....	300
Troutdale, Fox Creek.....	5,000	Merrytown Creek.....	300
Guffey Creek.....	4,000	Silver Spring Creek.....	300
Vienna, Difficult Creek.....	18,000	Upper Sheboygan River.....	2,000
Whithorn, Poverty Creek.....	1,800	Glen Flora, Main Creek, North Fork.....	2,000
Wytheville, Rosenbaum's pond.....	1,000	Grand Rapids, Big Four Creek.....	2,000
Tates Run.....	295	Hayward, Namakagan Creek.....	1,000
Washington:		Independence, Bost Valley Creek.....	500
Chevelah, Waitts Lake.....	4,800	Bruce Valley Creek.....	500
Colville, Applicant.....	*50,000	Chimney Rock Creek.....	500
Everett, Applicant.....	*50,000	Cooks Creek.....	500
Sumner, Glen Acorn Pond.....	10,000	Davis Valley Creek.....	500
Spokane, Glen Tana Pond.....	2,400	Dubiels Creek.....	500
Spokane River.....	*100,000	Fernright Creek.....	500
Tacoma, Falls Creek.....	2,500	George Lyga Creek.....	1,000
Tonasket, Loots Coulee Creek.....	*100,000	Grietz Creek.....	500
Vancouver, Battle Ground Lake.....	5,000	Hauge Creek.....	500
Lewis River, East Fork.....	10,000	Hawkenson Creek.....	500
Rock Creek.....	*50,000		
	5,000		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## RAINBOW TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued		Wisconsin—Continued.	
Independence, Hunts Valley Creek..	500	Wausau, Little Trappe River.....	500
Johnson Creek.....	500	Pine River.....	500
Kurths Creek.....	500	Trap River.....	500
Lindon Creek.....	500	Westby, Clockmaker Creek.....	500
Maloney Creek.....	500	Kapp Creek.....	500
Marsolch Creek.....	500	Twin Bluff Creek.....	500
North Branch Creek.....	500	Wilton, Kickapoo River.....	1,000
Olsen Creek.....	500	Winter, Phelan Creek.....	1,000
Palkowski Creek.....	500	Woodman, Little Green Creek.....	4,000
Plum Creek.....	500	Wyoming:	
Popes Creek.....	500	Beulah, Big Sand Creek.....	†2,000
Roskos Creek.....	500	Boneti Spring Branch.....	†1,000
Ruste Creek.....	500	Howes's pond.....	1,600
Schaffner Creek.....	500	Cody, Anderson Creek.....	4,000
Skogstad Creek.....	500	Shoshone River, South Fork.....	4,000
Traverse Creek.....	500	Douglas, Box Elder Creek.....	10,000
Ulberg Creek.....	500	Green Valley Lake.....	10,000
Ute Creek.....	500	La Prele Creek.....	10,000
Veum Creek.....	500	Evanston, Bear River.....	20,000
Zimmer Creek.....	500	Mill Creek.....	15,000
Kilbourn, Hulbert Creek.....	1,000	Sulphur Creek.....	8,000
La Crosse, Adams Valley Creek.....	500	Yellow Creek.....	10,000
Big Creek.....	1,000	Kemmerer, Hams Fork Creek.....	15,000
Burham Valley Creek.....	500	Lander, Baldwin Creek.....	3,000
Burns Creek.....	1,000	Crescent Lake.....	2,000
Chipmunk Cooley Creek.....	1,000	Grave Creek.....	2,000
Fish Creek.....	500	Gustave Lake.....	2,000
Fleming Creek.....	1,000	Little Popo Agie River.....	4,000
Mormon Cooley Creek.....	1,000	Louis Lake.....	3,000
Timber Cooley Creek.....	1,000	North Fork River.....	4,000
La Forge, Bear Creek.....	2,000	North Platte, North Platte River...	23,000
Manitowac, Devil River.....	500	Powell, Applegate Lake.....	3,750
Jambo Creek.....	500	Edmonds Lake.....	3,750
Kriwanek Creek.....	500	Enod Lake.....	3,750
Mishicot River.....	500	Everett Lake.....	2,500
Pigeon River.....	1,000	Gillette Lake.....	3,750
Marinette, Menominee River.....	3,000	Gravel Pit Pond.....	2,500
Mauston, Seven Mile Creek.....	500	Howell Lake.....	3,750
Norwalk, Moores Creek.....	1,500	Loftsgaarden Lake.....	3,750
Oakfield, Herman Creek.....	500	Long Lake.....	3,750
Pembine, Merryman Creek.....	1,000	Lucier Lake.....	3,750
Silver Creek.....	1,000	Me Lake.....	3,750
Rhineland, Four Mile Creek.....	500	Sawtooth Lake.....	3,750
Gudegast Creek.....	500	Sheep Creek.....	2,500
Hardell Creek.....	500	Wardlaw Lake.....	3,750
Lake Creek.....	500	Sheridan, Spear Pond (A).....	2,500
Pelican River.....	1,000	Spear Pond (B).....	2,500
River Falls, Kinnickinnick River.....	4,500	State Fish Hatchery.....	*100,000
Stone Lake, Little Godfrey Creek.....	1,000	Thermopolis, Cottonwood Creek.....	8,000
Pierce Lake.....	1,000	Japan: Kobe, Japanese Government...	*101,000
Stone Lake.....	1,000	Canada: Magog, Canadian Govern-	
Waukesha, Dopp Creek.....	2,000	ment.....	*96,000
Garret Creek.....	2,000		
Jones Creek.....	2,000		
Minick Creek.....	2,000		
Right Creek.....	2,000		
Williams Creek.....	2,000		
		Total a.....	{ *1,454,200 †250,200 2,574,942

## ATLANTIC SALMON.

Maine:		Maine—Continued.	
Brownsville, Pleasant River.....	†718,750	Oakfield, Mattawamkeag River, East Branch.....	†648,500
Dennysville, Dennys River.....	†21,000	Onawa, Greenwood Stream.....	†48,600
Dover, Piscataquis River.....	†625,000	Orland, Orland River.....	887
East Machias, East Machias River.....	†30,000		
Grindstone, Penobscot River, East Branch.....	†312,500		
Seebos River.....	†312,500	Total.....	{ †3,028,850 887
Monson, Davis Stream.....	†312,000		

a Lost in transit, 20,278 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LANDLOCKED SALMON.

Disposition.	Number.	Disposition.	Number.
<b>Maine:</b>		<b>Maine—Continued.</b>	
Abbott Village, Buttermilk Pond.....	†5,000	Walkers, Squa Pan Lake.....	30,000
Lake Juanita.....	†5,000	Webster, Chema Lake.....	†7,500
Sebec Lake.....	†12,500	Wescott, Little Ossepee Lake.....	2,511
Bangor, Penobscot River.....	†11,000	Wilton, Wilson Lake.....	†7,500
Bigelow, Little Jim Pond.....	†5,000	<b>Massachusetts:</b>	
Bucksport, Toddy Pond.....	10,000	East Northfield, Applicant.....	*10,000
Canton, Lake Anasgunticook.....	†12,500	Lee, Stockbridge Lake.....	2,230
Caribou, State fish commission.....	*301,000	<b>New Hampshire:</b>	
Columbia, Schoodic Pond.....	†8,000	Bradford, Massasecum Lake.....	1,674
Dedham, Green Lake.....	†15,000	Bristol, Newfound Lake.....	4,185
Manns Brook.....	†45,000	Canaan, Tewsbury Pond.....	3,348
Dexter, Puffers Pond.....	†5,000	Hillsboro, Island Pond.....	4,185
Eagle Lake, Eagle Lake.....	†75,000	Keene, Granite Lake.....	1,674
East Machias, Gardner Lake.....	†20,000	Silver Lake.....	2,511
East Orland, Toddy Pond.....	{ †7,480	Spoofford Lake.....	2,511
Ellsworth Falls, Vinan Lake.....	9,250	Lebanon, Crystal Lake.....	5,022
Enfield, Cold Stream Lake.....	†12,000	Meredith, Waukegan Lake.....	1,674
Farmington, Clear Water Lake.....	†17,500	Mountainview, Dan Hole Pond.....	1,674
Port Kent, Fish River.....	†7,500	Warren, State fish commission.....	*25,000
Franklin, Donnell Pond.....	†27,500	<b>New York:</b>	
Grand Lake, Dobsis Lake.....	†10,000	Arden, Forest Lake.....	*10,000
Grand Lake.....	{ †28,000	Hammondsport, Lake Keuka.....	†2,000
Harrington, Schoodic Pond.....	9,000	Long Lake, West Bear Pond.....	†1,000
Hartland, Great Moose Lake.....	†206,000	Doctors Pond.....	*5,000
Jackman, Lake Wood.....	64,814	Nehasane, Big Rock Lake.....	4,000
Kennebago, Kennebago Lake.....	†8,000	Lake Lila.....	4,000
Kineo, Moosehead Lake.....	†12,500	Port Jervis, Wood Lake.....	†1,970
Moose River.....	2,000	Raquette Lake, Bettner Ponds.....	*5,000
Roach River.....	†2,500	Lake Kora.....	*5,000
Newport Junction, Lake Sebasticook.....	†27,500	Mohegan Lake.....	*5,000
Nicolin, Nicolin Lake.....	†7,500	Warrensburg, State fish commission.....	*25,000
North Anson, Emden Pond.....	†5,000	<b>Vermont:</b>	
North Belgrade, Belgrade Lake.....	†20,000	Canaan, Big Averill Lake.....	725
Messalonskee Lake.....	†10,000	Little Averill Lake.....	580
Norway, Virginia Lake.....	†12,500	Greensboro, Caspian Lake.....	1,000
Otis, Green Lake.....	†12,500	Hardwick, Nichols Pond.....	1,000
Phillips Lake, Phillips Lake.....	†66,219	Newport, Echo Lake.....	1,500
Portage, Portage Lake.....	†12,000	Seymour Lake.....	2,000
Princeton, Big Lake.....	†15,000	Orleans, Willoughby Lake.....	2,756
Readfield, Parker Pond.....	†20,000	Roxbury, State fish commission.....	*40,000
South Paris, Abbott Pond.....	†10,000		
South Windham, State fish commis- sion.....	2,531		
	*100,000		
		<b>Total a.....</b>	{ *531,000 †798,689 177,635

## BLACKSPOTTED TROUT.

<b>Arizona:</b>		<b>Colorado—Continued.</b>	
Safford, Fry Canyon Creek.....	2,000	Breckenridge, Upper Blue Lake.....	3,000
Marijilda Creek.....	2,000	Buena Vista, Cottonwood Lake.....	4,000
<b>Colorado:</b>		Kroenke Lake.....	3,000
Almont, Spring Creek.....	10,000	Middle Cottonwood Creek.....	8,000
Antero, Antero Lake.....	25,000	Buffalo, Buffalo Creek.....	25,000
South Platte River.....	15,000	Goose Creek.....	4,000
Aspen, Brush Creek.....	2,000	Carbondale, Roaring Fork River.....	22,500
Colfax Lake.....	2,000	Castles, Frying Pan River.....	5,000
Conumdrum Creek.....	2,000	Cather Springs, Little Faountain Creek.....	3,000
Lost Man Creek.....	2,000	Cebolla, Gunnison River.....	50,000
Maroon Creek.....	3,000	Chromo, Big Navajo River.....	17,000
Roaring Fork Creek.....	3,000	Little Navajo River.....	7,000
Austin, Beaverdam Lake.....	3,000	Cimarron, Big Cimarron River.....	5,000
Lost Lake.....	3,000	Big Red Creek.....	5,000
Youngs Creek.....	2,000	Cimarron River.....	8,000
Avon, Lake Creek, East and West Forks.....	12,000	Dry Creek, East and West Forks.....	5,000
Turquoise Lake.....	15,000	Horsely Creek.....	5,000
Baldwin, Castle Creek.....	5,000	Little Cimarron River.....	2,000
Mill Creek.....	10,000	Little Red Creek.....	5,000
Ohio Creek.....	10,000	Lower Cimarron River.....	3,000
Pass Creek.....	5,000	Roubideau Creek.....	5,000
Basalt, Kellys lake.....	5,000	Spring Creek.....	4,000
Bearcreek, Bear Creek.....	5,000	Coke Owens, West Dolores River.....	5,000

a Lost in transit, 33,000 fry; 16,530 fingerlings.



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BLACKSPOTTED TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Colorado—Continued.		Colorado—Continued.	
Colorado Springs, Broadmoor Lake .	30,000	Hotchkiss, Clear Fork Creek .	2,000
Como, Sacramento Creek .	2,000	Crystal Creek .	8,000
Tarryall Creek, North Fork .	2,000	Leroux Creek .	5,000
Twelve Mile Creek .	3,000	Smith Fork Creek .	2,000
Cotopaxi, Cottonwood Creek .	5,000	Idaho Springs, Bear Creek .	3,000
Creede, Rio Grande River .	40,000	Fall River .	3,000
Crested Bluff, Anthracite Creek .	10,000	Vance Creek .	2,000
Brush Creek .	10,000	Lake George, South Platte River,	
Coal Creek .	5,000	South Fork .	5,000
East River .	5,000	La Veta, Cuchara Creek .	5,000
Slate River .	5,000	Leadville, Fryng Pan River and	
Washington Gulch Creek .	5,000	tributaries .	30,000
Cripple Creek, Gillett Lake .	6,000	Mancos, West Mancos Creek .	5,000
Debeque, Big Creek .	4,000	Midland, Lashbaugh Lakes .	3,000
Bull Creek .	4,000	Monte Vista, Alamosa Creek .	6,000
Buzzard Creek .	4,000	Conejos River .	6,000
Coon Creek .	3,000	Rock Creek, South Fork .	4,000
Grove Creek .	3,000	New Castle, Fawn Creek .	3,000
Kahnah Creek .	2,000	Ripple Creek .	3,000
Mesa Creek .	3,000	West Miller Creek .	3,000
Plateau Creek .	3,000	Newett, Teeter's ponds .	4,000
Del Norte, Elk Creek .	10,000	North Cheyenne, Cheyenne Creek,	
Denver, Bear Creek .	12,000	North Fork .	3,000
Dillon, Boulder Creek .	3,000	Northgate, North Platte River .	10,000
Cow Creek .	2,000	Ohio City, Gold Creek .	2,000
Martin Creek .	2,000	Ouray, Poughkeepsie Creek .	5,000
Durango, Canyon Creek .	3,000	Pagosa Springs, Big Blanco River .	20,000
Cascade Creek .	4,000	Little Blanco River .	8,000
Clear Creek .	3,000	San Juan River, East Fork .	9,000
Dutch Creek .	3,000	San Juan River, West Fork .	18,000
Elk Creek .	3,000	Pando, Eagle River .	30,000
Florida River .	5,000	Paonia, East Muddy Creek .	10,000
Hermosa Creek .	9,000	Henderson Creek .	3,000
Junction Creek .	9,000	Laroux Creek .	5,000
La Plata River .	10,000	Terror Creek .	3,000
Lightner Creek .	5,000	Parkdale, Arkansas River .	3,000
Lime Creek .	4,000	Parshall, Grand River, South Fork .	4,500
Los Pinos Creek, South Fork .	3,000	Pitkin, Boulder Lake .	3,000
Needle Creek .	3,000	Chaney Lake .	2,000
Edwards, Squaw Creek .	4,000	Lampshire Lake .	3,000
Eldora, Boulder Creek .	40,000	Quartz Creek .	5,000
Florence, South Hardscrabble Creek .	5,000	Placerville, Naturita Creek .	18,000
Fort Collins, Bennett Creek .	† 20,000	Ridgeway, Big Cimarron Creek .	5,000
Joe Wright Creek .	† 40,000	Cow Creek .	5,000
Little South Poudre River .	† 80,000	Escalante Creek .	2,000
McIntyre Creek .	† 20,000	Uncompahgre River .	5,000
Poudre River, North Fork .	105,000	Rifle, Beaver Creek .	5,000
Sheep Creek .	† 10,000	East Divide Creek .	7,500
Trap Lake .	† 15,000	West Divide Creek .	5,000
Fraser, Corona Lakes .	9,000	Rosemont, East Beaver Creek .	15,000
Ranch Creek .	20,000	Ruedi, Ruedi Creek .	2,000
Frisco, Meadow Creek .	3,000	Smith Creek .	2,000
North Ten Mile Creek .	3,000	Saderland, Gould Creek .	15,000
Georgetown, Clear Creek, South		Salida, Bear Creek .	5,000
Fork .	2,000	Sapinero, Curucanti Creek .	5,000
Clear Lake .	5,000	West Elk Creek .	5,000
Green Lake .	5,000	Shawnee, Deer Creek .	25,000
Glenwood Springs, Grizzly Creek .	10,000	Silverton, South Mineral Creek .	3,000
Granby, Bowen Creek .	4,500	Somerset, Anthracite Creek .	3,000
Fern Lake .	7,500	West Muddy Creek .	10,000
Fish Creek .	4,500	South Fork, Alder Creek .	2,000
Fraser River .	20,000	Bear Creek .	4,000
Grand Lake .	9,000	Dyer Creek .	6,000
Grand River, North Fork .	16,000	Elk Creek .	2,000
Indian Creek .	10,000	Embargo Creek .	2,000
Stillwater Creek .	3,000	Rio Grande, South Fork .	4,000
Strawberry Creek .	10,000	Willow Creek .	4,000
Supply Creek .	3,000	South Platte, South Platte River .	25,000
Willow Creek .	6,000	Steamboat Springs, Buffalo Pass	
Grand Junction, Blue Creek .	12,000	Lake .	10,000
Granite, Clear Creek .	4,000	Harrison Creek .	4,500
Fine Creek .	4,000	Mad Creek, North Fork .	4,000
Grant, Geneva Creek .	33,000	Slater Creek .	4,000
Gypsum, Gypsum Creek .	8,000	Stoner Creek, Stoner Creek .	5,000
Hartsel, High Creek .	4,000	Sulphur Springs, Corral Creek .	14,500
Hierro, North Beaver Creek .	10,000	Willow Creek .	10,000
Sun Creek .	10,000	Sunset, Four Mile Creek .	10,000
Hinkles, Mill Creek .	10,000		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BLACKSPOTTED TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Colorado—Continued.		Montana—Continued.	
Thomasville, Engelbrecht Lake. ....	60,000	Livingston, Ferry Creek. ....	†4,000
Troublesome, East Troublesome Creek. ....	6,000	Fleshman Creek. ....	†4,000
West Troublesome Creek. ....	7,500	Strickland Creek. ....	†4,000
Vasquez, Fraser River. ....	7,500	Upper Mission Creek. ....	†4,000
Vasquez Creek. ....	6,000	West Boulder River. ....	†6,000
Victor, Victor Lake. ....	10,000	Yellowstone River. ....	†18,000
Walden, Ute Creek. ....	10,000	Missoula, Bitter Root River, branch of. ....	†2,000
Walsenburg, Huerfano River. ....	10,000	Blanchard Creek. ....	†8,000
Ward, Middle St. Vrain River. ....	3,000	Canas Creek. ....	†8,000
Webster, South Platte River. ....	20,000	Cottonwood Creek. ....	†6,000
Westcliffe, Bear Lake. ....	4,000	Grant Creek. ....	†8,000
Grape Creek. ....	10,000	Johnson Creek. ....	†8,000
North Colony Creek. ....	4,000	Lo Lo Creek. ....	†10,000
South Colony Creek. ....	4,000	Mill Creek. ....	†8,000
Wheeler, West Ten Mile Creek. ....	3,000	Miller Creek. ....	†8,000
Wray, Republican River. ....	5,000	Rock Creek. ....	†10,000
Youman, Big Blue Creek. ....	5,000	Twin Creeks. ....	†4,000
Michigan:		Moccasin, Porter Creek. ....	†6,000
Detroit, Applicant. ....	*20,000	Moore, Fessell's pond. ....	†2,000
East Tawas, Silver Creek. ....	†5,000	Rock Creek. ....	†6,000
Montana:		Rosfork Creek. ....	†10,000
Anaconda, Cable Creek. ....	†4,000	Pony, North Willow Creek. ....	†8,000
California Creek. ....	†6,000	South Willow Creek. ....	†8,000
Deep Creek. ....	†6,000	Watt Lake. ....	†10,000
Dutchman Creek. ....	†4,000	Pray, Mill Creek, North Fork. ....	†4,000
Fish Trap Creek. ....	†6,000	Mill Creek, South Fork. ....	†4,000
Foster Creek. ....	†6,000	Strawberry Creek. ....	†4,000
La Marsh Creek. ....	†6,000	Roundup, Flatwillow Creek. ....	†10,000
Lost Creek. ....	†6,000	Willow Creek. ....	†8,000
Mill Creek. ....	†6,000	Sheridan, Indian Creek. ....	†6,000
Seymour Creek. ....	†6,000	Mill Creek. ....	†8,000
State fish commission. ....	*400,000	Wisconsin Creek. ....	†10,000
Warm Springs Creek. ....	†6,000	Shonkin, Shonkin Creek. ....	†10,000
Willow Creek. ....	†4,000	Stevensville, Bass Creek. ....	†6,000
Billings, Blue Creek. ....	†6,000	Mill Creek. ....	†6,000
Bozeman, Dry Creek. ....	†4,000	South Burnt Fork Creek. ....	†6,000
Spring Creek. ....	†4,000	Spring Creek. ....	†2,000
Butte, Applicant. ....	*200,000	Superior, Cedar Creek. ....	†4,000
Carbella, Lower Rock Creek. ....	†4,000	Deep Creek. ....	†4,000
Miner Creek. ....	†4,000	Dry Creek. ....	†4,000
Choteau, Teton River. ....	†12,000	Fish Creek. ....	†6,000
Clyde Park, Bang Tail Creek. ....	†4,000	Flat Creek. ....	†4,000
Canyon Creek. ....	†4,000	Fourteen Mile Creek. ....	†4,000
Cole Creek. ....	†4,000	Johnston Creek. ....	†4,000
Mission Creek. ....	†6,000	Lost Gulch Creek. ....	†4,000
Rock Creek. ....	†4,000	Oregon Gulch Creek. ....	†4,000
Corwin Springs, Big Creek. ....	†6,000	Quartz Creek. ....	†4,000
Castle Lake. ....	†6,000	Thompson Creek. ....	†6,000
Cedar Creek. ....	†6,000	Trout Creek. ....	†6,000
Cutler Lake. ....	†4,000	Sweet Grass, Forest Creek. ....	†16,000
Dalleys Creek. ....	†4,000	Townsend, Dry Creek. ....	†8,000
Randall Lake. ....	†4,000	Greyson Creek. ....	†8,000
Dell, Cyot Creek. ....	†12,000	Twodot, Big Elk Creek. ....	†8,000
Muddy Creek. ....	†12,000	Wilsall, Coal Creek. ....	†4,000
Dillon, Hoffman Creek. ....	†4,000	Crandall Creek. ....	†4,000
Emigrant, Dam Creek. ....	†4,000	Daisy Dean Creek. ....	†4,000
Lambert Creek. ....	†4,000	Elk Creek, North Fork. ....	†4,000
Simon Creek. ....	†4,000	Flathead Creek, South Fork. ....	†4,000
Six Mile Creek. ....	†6,000	Flathead Creek, West Fork. ....	†4,000
Forest Grove, Flatwillow Creek, North Fork. ....	†4,000	Horse Creek. ....	†6,000
Hell Creek. ....	†4,000	Little Muddy Creek. ....	†4,000
McCartney Creek. ....	†4,000	North Horse Creek. ....	†4,000
Tyler Creek, Spring Branch. ....	†4,000	Porcupine Creek. ....	†6,000
Tyler Creek, West Fork. ....	†4,000	Potter Creek. ....	†4,000
Gardner, Gardner River. ....	†6,000	Shields River, South Fork. ....	†4,000
Yellowstone River. ....	†6,000	Smuth Creek. ....	†4,000
Grannis Siding, Lower Shields River. ....	†6,000	Upper Flathead River. ....	†4,000
Helena, Prickly Pear Creek. ....	†16,000	Upper Horse Creek. ....	†4,000
Hobson, Antelope Creek. ....	†8,000	New Mexico:	
Judith Gap, Judith River, Ross Fork. ....	†8,000	Buckman, Pajarito River. ....	5,000
Lewistown, Cottonwood Creek. ....	†4,000	Rito de los Frijoles. ....	3,000
McMillan's pond. ....	†4,000	Capitan, Rio Ruidoso. ....	5,000
Libby, Pipe Creek. ....	†8,000	Carlsbad, Carlsbad Creek. ....	2,000
Quartz Creek. ....	†8,000	Chama, Brazos River. ....	5,000
Livingston, Bloom Lake. ....	†4,000	Canones Creek. ....	4,000
Brisbin Creek. ....	†2,000	Chama River. ....	6,000
Cokedale Creek. ....	†4,000	Chavez Creek. ....	5,000
Elbow Creek. ....	†4,000	Nutrias River. ....	5,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BLACKSPOTTED TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
<b>New Mexico—Continued.</b>		<b>South Dakota—Continued.</b>	
Clouderoff, Water Canyon Creek.....	3,000	Rochford, Little Rapid Creek.....	†25,000
Dexter, Pecos River.....	1,000	Savoy, Spearfish River.....	†20,000
Florida Station, Hadley Creek.....	2,000	State fish commission.....	†30,000
Glorietta, Bear Creek.....	3,000	Spearfish, Crow Creek.....	†15,000
Cow Creek.....	3,000	Eccles Creek.....	†10,000
El Rito del Moreno Creek.....	3,000	Higgins Gulch Creek.....	†10,000
Holy Ghost Creek.....	2,000	Lindley Creek.....	†8,000
Indian Creek.....	5,000	Schmidt's lake.....	†15,000
Jacks Creek.....	2,000	Smith Spring Branch.....	†5,000
Mora Creek.....	2,000	Spearfish Creek.....	65,000
Panchuelo Creek.....	6,500	Spearfish Creek, branches of.....	†31,000
Pecos River.....	12,000	Spring Creek.....	25,000
Willow Creek.....	3,000	Watercress Creek.....	†5,000
Windsor Creek.....	3,000	Willow Creek.....	†6,000
Grants, Laguna Redonda.....	2,000	Sturgis, Bear Butte Creek.....	†25,000
Laguna, Water Canyon Creek.....	3,000	Utah: Murray, State fish commission.....	*100,000
Las Vegas, Falls Creek.....	3,000	Washington:	
Luna Creek.....	4,000	Aberdeen, Charley Creek.....	†6,000
Pecos River.....	22,000	Chenaise Creek.....	†4,000
Rio de la Casa.....	2,000	Elk River.....	†6,000
Rio Gallinas.....	13,000	Hogquiam River.....	†6,000
Tecolote Creek.....	3,000	Humtuplups River.....	†6,000
Mountainair, Tajique Canyon Creek.....	6,000	Indian Creek.....	†4,000
Raton, Palo Blanco Creek.....	3,000	Johns River.....	†4,000
Schwachheim Creek.....	3,000	Stevens Creek.....	†8,000
Seighstrom Creek.....	3,000	Van Winkle Creek.....	†4,000
Walton Creek.....	3,000	Wynoochee River.....	†4,000
Waterworks Pond.....	3,000	Asotin, Asotin Creek.....	†20,000
Wrigelsworth Creek.....	3,000	Chelan, Antilon Lake.....	†8,000
Roberia, Pecos River.....	5,000	Cleelum, Applicant.....	*50,000
Santa Fe, Capulin River.....	3,000	Kelso, Clark Creek.....	†4,000
Nambe River.....	5,000	Owl Creek.....	†4,000
Rio Medio.....	7,000	Northport, Deep Creek.....	†4,000
Rito Pacheco.....	2,000	Little Sheep Creek.....	†4,000
Santa Fe River.....	13,000	Onion Creek.....	†4,000
Tesuque River.....	6,000	Sheep Creek.....	†6,000
Taiban, Taiban Creek.....	1,000	Port Angeles, State fish commission.....	*150,000
Taos Junction, Rio Pueblo.....	5,000	Snoqualmie, Applicant.....	*50,000
Taos Creek.....	5,000	Stevenson, Lake Toketa.....	†8,000
Tres Piedras, Rio Vallecitos.....	6,000	Nocema Lake.....	†6,000
Ute Park, Beaver Creek.....	3,000	Tacoma, Canada Creek.....	†6,000
Cimarron River.....	3,000	Chambers Creek.....	†6,000
Hurricane Creek.....	1,500	Chenius Creek.....	†6,000
Red River.....	38,500	Clear Creek.....	†6,000
Six Mile Creek.....	3,000	Falls Creek.....	†6,000
West Agua Fria Creek.....	3,000	Golden Lake.....	†6,000
Wagonmound, Tyson Springs Creek.....	1,000	Hyehos Creek.....	†6,000
New York: New York, Aquarium.....	*10,000	Lake Ethel.....	†6,000
<b>Oregon:</b>		Lake James.....	†6,000
Bonneville, State fish commission.....	*250,000	Little Mashell River.....	†6,000
Rogue River, Rogue River.....	8,000	Ranger Creek.....	†6,000
<b>South Dakota:</b>		Rushing Water Creek.....	†6,000
Big Bend, Minnelusa Creek.....	†2,000	Skukewush Creek.....	†6,000
Prairie Creek.....	†8,000	South Mowich River.....	†6,000
Englewood, Englewood Creek.....	†5,000	Vancouver, Bert Creek.....	†8,000
Rapid Creek.....	25,000	Big Creek.....	†8,000
Hill City, Barthold Pond.....	†4,000	Cedar Creek.....	†8,000
Horse Creek.....	†6,000	Little Washugal River.....	†8,000
Hot Springs, Cascade Creek.....	†8,000	Washugal River.....	{ *50,000
Iron Creek, Iron Creek.....	51,400	Washugal River, North Fork.....	†8,000
Lead, Spearfish Creek, Upper.....	†15,000	Walla Walla, State fish commission.....	*50,000
Whitewood Creek.....	†20,000	<b>Wyoming:</b>	
Mystic, Tunnell Creek.....	†8,000	Bonneville, Big Horn River.....	†14,000
Pactola, Bogus Jim Creek.....	†6,000	Clearmont, Crazy Woman Creek,	
Jim Creek.....	†10,000	Middle Fork.....	†11,000
Keenan Pond.....	†2,000	Mabel Lake.....	†11,000
Longs Pond.....	†2,000	Magdalene Lake.....	†10,000
Power Lake.....	†4,000	Muddy Creek.....	†12,000
Victoria Creek.....	†6,000	Paradise Lake.....	†12,000
Rapid City, Box Elder Creek.....	†22,000	Tiger Lake.....	†10,000
Canyon Lake.....	†8,000	Cody, Anderson Creek.....	†8,000
City Spring Creek.....	†4,000	Eleanor Creek.....	†8,000
Cleghorn Spring Creek.....	†4,000	Shoshone River, North Fork.....	†12,000
Haley Lake.....	†4,000	Shoshone River, South Fork.....	†12,000
Halls Pond.....	†4,000	Sunlight Creek.....	†8,000
Indian School Lake.....	†4,000	Wood River.....	†12,000
Lime Creek.....	†5,000	Cow Creek, Cow Creek.....	20,000
Rapid Creek.....	†25,000	Encampment, Encampment Creek,	
Spayde Pond.....	†4,000	South Fork.....	135,000
Spring Creek.....	†24,000		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BLACKSPOTTED TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wyoming—Continued.		Wyoming—Continued.	
Jack Creek, Jack Creek.....	190,000	Sheridan, Sackett Pond.....	†8,000
Laramie, State fish commission.....	*100,000	State fish commission.....	*100,000
Manderson, Nowood River.....	†37,400	Twin Lakes.....	†6,000
State fish commission.....	*100,000	Spring Creek, Spring Creek and tributaries.....	70,000
Newcastle, M. W. Ranch Lake.....	†20,000	Yellowstone, Bridge Creek.....	†42,000
Pass Creek, Pass Creek.....	60,000	Buffalo Creek.....	†60,000
Powell, Chain of Lakes.....	†12,000	Clear Creek.....	†28,000
Mirror Lake.....	†12,000	Columbine Creek.....	†21,000
Rock Creek, Rock Creek.....	20,000	Pelican Creek.....	†42,000
Rock River, Sand Lake.....	15,000		
Saratoga, North Platte River.....	50,000		
Sheridan, Jackson Creek.....	†15,000		
Lake Geneva.....	†10,000		
Rapid Creek.....	†15,000		
		Total a.....	{ *1,630,000 †2,051,400 2,683,900

## LOCH LEVEN TROUT.

South Dakota:		South Dakota—Continued.	
Belle Fourche, Orman Reservoir....	25, 835	Deadwood, City Park Lake.....	25

## LAKE TROUT.

Colorado:		Michigan—Continued.	
Leadville, Twin Lakes.....	40,000	Point Abbaye, Keweenaw Bay.....	†100,000
Montrose, Tripler Lake.....	10,000	Presque Isle, Lake Superior.....	†565,000
Illinois: Chicago, Applicant.....	*2,000	St. Ignace, Lake Michigan.....	†157,500
Iowa: Spirit Lake, State fish commission.....	*100,000	St. Joseph, Lake Michigan.....	†429,000
Maine:		Sault Ste. Marie, State fish commission.....	*8,640,000
Greenville Junction, State fish commission.....	*100,000	Scarecrow Island, Lake Huron.....	†1,022,000
Winthrop, State fish commission.....	*100,000	Sidnaw, Hauger Lake.....	8,000
Massachusetts:		Skillogalee Reef, Lake Michigan.....	†931,000
Chester, Big Pond.....	2,500	Tobens Harbor, Lake Superior.....	†600,000
Lee, Goose Pond.....	2,500	Todds Harbor, Lake Superior.....	†600,000
Greenwater Pond.....	2,500	Traverse Island, Keweenaw Bay.....	†100,000
Laurel Lake.....	2,500	Washington Harbor, Lake Superior.....	200,000
Shaw Pond.....	2,500	Wrights Island, Lake Superior.....	{ †492,000 480,000
Stockbridge Lake.....	2,500	Minnesota:	
Michigan:		Burlington Point, Lake Superior....	†550,000
Big Rock Reef, Lake Michigan.....	†1,148,000	Duluth, Lake Superior.....	100,000
Charlevoix, Lake Michigan.....	†1,148,000	Encampment Island, Lake Superior.....	†500,000
Charlevoix Reef, Lake Michigan.....	†1,148,000	French River, Lake Superior.....	†550,000
Covington, Worm Lake.....	6,000	Grand Portage, Lake Superior.....	†802,500
Crystal Falls, Berg's pond.....	†6,000	Knife River, Lake Superior.....	†500,000
Detour, Lake Huron.....	†380,000	Pillinger, Shamneau Lake.....	10,000
Escanaba, Lake Michigan.....	†105,000	St. Paul, State fish commission.....	*3,300,000
Fishermens Home, Lake Superior.....	{ †492,000 480,000	Stewart River, Lake Superior.....	†550,000
Fish Island, Lake Superior.....	†564,000	Sucker River, Lake Superior.....	{ †550,000 498,000
Fishermens Island, Lake Michigan.....	†2,296,000	Susie Island, Lake Superior.....	†627,500
Gaylord, Brink Lake.....	†6,000	Montana:	
Gull Island Reef, Lake Huron.....	†1,024,000	Whitefish, Beaver Lake.....	16,500
Horseshoe Reef, Lake Michigan.....	†1,095,000	Whitefish Lake.....	21,000
Iron River, Iron Lake.....	†6,000	New Hampshire:	
Pickereel Lake.....	†9,000	Bradford, Long Pond.....	4,000
Sunset Lake.....	†12,000	Massachusetts Lake.....	4,000
Isle Royal, Lake Superior.....	480,000	Bristol, Newfoundland Lake.....	10,000
King Lake Siding, Big King Lake.....	6,000	Fitzwilliam, Laurel Lake.....	4,000
Little King Lake.....	6,000	Lebanon, Cole Pond.....	9,600
Long Point, Lake Superior.....	960,000	Crystal Lake.....	1,500
McCargo's Cove, Lake Superior.....	†200,000	Pike, Lake Tarleton.....	2,413
Manistee, Lake Michigan.....	†432,000	New York:	
Manistique, Lake Michigan.....	†283,500	Albany, State fish commission.....	*3,000,000
Marquette, Lake Superior.....	†490,000	Allan Otty Shoal, Lake Ontario.....	†337,500
Munising, Lake Superior.....	250,000	Au Sable Forks, Crystal Lake.....	†9,000
Nine Mile Point, Lake Michigan.....	†1,094,000	Taylor Pond.....	†6,000
Northpoint Reef, Lake Huron.....	†872,000	Bear Point, Lake Ontario.....	†209,600
Old Athhead Reef, Lake Michigan.....	†1,094,000	Caledonia, State fish commission.....	*2,490,000
Piney River, Keweenaw Bay.....	†300,000	Charity Shoals, Lake Ontario.....	†1,021,000

a Lost in transit, 1,000 fry; 14,500 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LAKE TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
New York—Continued.		Vermont:	
Dutch Point, Lake Ontario.....	†368,000	Barton, Crystal Lake.....	3,750
Fox Island, Lake Ontario.....	†697,500	Bennington, State fish commission.....	*100,000
Grenadier Island, Lake Ontario.....	†1,642,450	Canaan, Big Averill Lake.....	1,825
Hammondsport, Lake Keuka.....	†10,000	Greensboro, Caspian Lake.....	1,470
Interlaken, Cayuga Lake.....	†10,000	Hardwick, Nichol's pond.....	1,600
Lake George, Lake George.....	†15,000	Holden, Lake Dunmore.....	2,500
Lake Placid, Lake Placid.....	†20,000	Middlebury, Lake Dunmore.....	6,000
Long Lake West, Loon Pond.....	*50,000	Orleans, Long Pond.....	3,900
Northville, Sacondaga Lake.....	{ †8,000	Willoughby Lake.....	4,000
	1,600	Roxbury, State fish commission.....	*1,400,000
Pigeon Island, Lake Ontario.....	†100,000	Washington: Tonasket Applicant.....	*200,000
Point Peninsula, Lake Ontario.....	†638,500	Wisconsin:	
Port Henry, Clear Pond.....	†6,000	Bayfield, State fish commission.....	*3,000,000
Port Jervis, Cahoonie Lake.....	†9,000	Delta, Spring Lake.....	†10,000
Raquette Lake, Lake Sagamore.....	*50,000	Donaldson, Black Oak Lake.....	10,000
Redwood, Millsite Lake.....	†15,000	Gordon, Eau Claire Lakes.....	†10,000
Riverside, Paradox Lake.....	†10,000	Madison, State fish commission.....	*4,000,000
Schroon Lake.....	†10,000	State fish commission.....	*6,000,000
Saranac Lake, Pine Pond.....	†15,000	Pelican, Pelican Lake.....	8,000
Skaneateles Junction, Skaneateles Lake.....	†36,000	Pembine, Boulder Lake.....	†9,000
Stony Point, Lake Ontario.....	†630,250	Coldwater Lake.....	†9,000
Tibbets Point, Lake Ontario.....	†491,355	Lindquist Lake.....	†9,000
Ohio:		Round Lake.....	†9,000
Grafton, Quarry Pond.....	†3,000	Port Wing, Lake Superior.....	†2,200,000
Isle of St. George, Lake Erie.....	†490,000	Wyoming:	
Marblehead, Lake Erie.....	†500,000	Clearmont, Paradise Lake.....	1,000
Put in Bay, State fish commission.....	*600,000	Lander, Atlantic Lake.....	2,500
Oregon: Bonneville, State fish commission.....	*1,000,000	Louis Lake.....	2,500
Pennsylvania:		Poposia Lake.....	2,500
Bellefonte, State fish commission.....	*500,000	Pyramid Lake.....	2,500
Pleasant Mount, State fish commission.....	*500,000	Sandy Lake.....	2,500
South Dakota:		Laramie, State fish commission.....	*100,000
Bellefourche, Ormande Reservoir.....	13,500	Riverton, Brooks Lake.....	2,500
Rapid City, Boegel's pond.....	750	Sheridan, State fish commission.....	*100,000
Electric Light Pond.....	1,500		
Thompson's pond.....	750		
		Total a.....	*35,332,000
			†33,395,155
			3,699,158

## BROOK TROUT.

Alaska: Juneau, Salmon Creek Lake.....	*150,000	Colorado—Continued	
Arizona:		Cimarron, Big Cimarron River.....	31,000
Globe, Reynolds Creek.....	4,000	Lake No. 2.....	10,000
Tempe, Tonto Creek.....	4,000	Lake No. 3.....	8,000
California:		Silver Tip Lake.....	12,000
Baird, Salt Creek.....	5,000	Cliff, South Platte River.....	66,000
Sacramento River, branch of.....	5,000	Colona, Buckhorn Lake.....	1,000
Colton, Fox Creek.....	1,000	High Park Lake.....	2,000
Fox Lake.....	1,000	Onion Creek Lakes.....	2,000
El Monte, Win Mor Pond.....	1,000	Sink Hole Lake.....	1,000
Hancock, Squaw Creek.....	5,000	Tie Camp Lake.....	1,000
Hickman, Riverview Lake.....	1,000	Colorado Springs, Fountain Creek.....	25,000
Lancaster, McIntosh's pond.....	1,000	Langridge Ponds.....	25,000
Point Reyes Station, Lime Gulch Creek.....	*25,000	Creede, Red Mountain Creek.....	10,000
Rosamond, Graves's pond.....	1,000	Rio Grande River.....	15,000
Truckee, Martis Creek.....	2,000	Shallow Creek.....	10,000
Prosser Creek.....	7,000	Sunnyside Creek.....	10,000
Colorado:		Trout Creek.....	10,000
Antero, Antero Lake.....	6,000	Cripple Creek, Gehm's pond.....	3,000
Aspen, Express Creek.....	9,000	Crossons, Crossons Nursing Pond.....	500
Austin, Twin Lakes.....	15,000	Curtin, Uneva Lake.....	9,000
Bailey, Deer Creek.....	1,500	Delta, Current Creek.....	10,000
South Platte River.....	84,000	Dirty George Creek.....	4,000
Basalt, Cattle Creek.....	15,000	Happy Hollow Creek.....	15,000
Biglow, Last Chance Creek.....	12,000	Spruce Creek.....	15,000
North Fryng Pan River.....	15,000	Younge Creek.....	40,000
Boulder, Boulder Creek.....	18,000	Denver, Bear Creek.....	20,000
Bowie, Hubbard Creek.....	10,000	Covert's pond.....	800
Buena Vista, Days Lake.....	6,000	Indian Creek.....	5,000
Canon City, Beaver Creek.....	15,000	Dillon, Slate Creek.....	10,000
		Divide, Loshbaugh's pond.....	6,000

a Lost in transit, 25,000 fry; 1,565 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Colorado—Continued.		Colorado—Continued.	
Durango, Florida River.....	10,000	Ridgway, Dallas Creek.....	15,000
Eagle, Brush Creek.....	36,000	Rifle, Rifle Creek.....	15,000
Eldora, Boulder Creek, North Fork.....	20,000	Ruedi, Freeman Creek.....	2,500
Lake Eldora.....	9,000	Frying Pan River.....	30,000
Fraser, Corona Lakes.....	20,000	Rocky Fork Creek.....	5,000
Glenwood Springs, Grizzly Creek.....	24,000	Salida, Pass Creek.....	51,000
No Name Creek.....	10,000	Poncha Creek.....	9,000
Granby, Baker Creek.....	10,000	South Arkansas River.....	25,000
Grand River.....	15,000	Sapinero, Gunnison River.....	20,000
Granite, Clear Creek.....	100,000	Sellar, Sellar Lake.....	5,000
Grant, Blue River.....	2,500	Shawnee, Deer Creek.....	22,000
Greenland, Alice Reservoir.....	6,000	Shoshone, No Name Creek.....	6,000
Green Mountain Falls, Catamount Creek.....	9,000	Silverton, Molas Creek.....	5,000
Hillside, Road Pond.....	2,000	South Mineral Creek.....	5,000
Hill Siding, North Boulder Creek.....	80,000	Sloss, Frying Pan River.....	10,000
Hotchkiss, Crystal Creek.....	5,000	South Platte, South Platte River, South Fork.....	9,000
Smith Fork Creek.....	5,000	Thomasville, Eagle Lake.....	2,500
Idaho Springs, Lake Edith.....	36,000	Engelbrecht Lakes.....	230,000
Iola, Rainbow Lake.....	10,000	Howard Lake.....	4,000
Ivanho, Ivanho Lake.....	15,000	Lime Creek.....	5,000
Lyle Creek.....	6,000	Spring Creek.....	30,000
Morman Lake.....	20,000	Trinidad, Arkansas River.....	25,000
Jefferson, Rock Creek.....	15,000	Purgatory River, Middle Fork.....	40,000
Lake City, Gunnison River, Upper Lake Fork.....	16,000	Victor, Beaver Lake.....	6,000
Lake George, Pierce's pond.....	6,000	Bison Park Lake.....	30,000
South Platte River.....	4,500	Hughlitt's pond.....	4,000
Leadville, Arkansas River.....	71,000	Skaguay Lake.....	6,000
Badger Creek.....	8,000	Webster, South Platte River.....	18,000
Box Creek.....	6,000	Weller, Clear Creek.....	12,500
Crystal Lake.....	25,000	Woodland Park, Club Pond.....	1,500
Half Moon Creek.....	53,000	Crystal Pond.....	6,000
Lake Creek.....	76,000	Engelbrecht Lakes.....	50,000
Lake Park Creek.....	15,000	Fourth Lake.....	15,000
Musgrove Lake.....	120,000	Hay Creek.....	9,000
Rock Creek.....	15,000	Lake No. 2.....	9,000
Tennessee Creek.....	33,000	Northfield Lakes.....	18,000
Timber Line Lake.....	15,000	Woodland Park Lakes.....	73,000
Turquoise Lake.....	202,000	Connecticut:	
Twin Lakes.....	44,000	Bethel, Diamond Hill Brook.....	400
Twin Lakes Creek.....	15,000	Flanders, Won-Bec-Water Creek.....	3,125
Union Creek.....	21,000	Forestville, Morris Pond.....	300
Willow Creek.....	22,000	Granby, Hurricane Brook.....	300
Loveland, St. Vrain River.....	15,000	Hartford, Broad Brook.....	2,300
Maddox, Platte River.....	20,000	Spring River.....	2,000
Malta, Frenchman Pond.....	500	West Brook.....	800
Smith Ponds.....	9,000	New Canaan, Five-Mile River.....	2,500
Marble, Lizard Lake.....	10,000	Frog Town Brook.....	3,000
Snow Mass Creek.....	6,000	Mill River.....	5,000
Marshall Pass, Arkansas River, North Fork.....	20,000	Mill River, East Branch.....	3,000
Greens Gulch Creek.....	20,000	Norwalk River, West Branch.....	2,500
Littel Cochetopa Creek.....	20,000	Silvermine River.....	5,000
Poncho Creek.....	20,000	New London, Beaver Brook.....	18,000
Silver Creek.....	20,000	Cedar Brook.....	77,000
Meredith, Jakenson Creek.....	5,000	Jordan Brook.....	18,000
Minturn, Cross Creek.....	15,000	Latimers Brook.....	116,000
Echo Lakes.....	9,000	New Milford, Cobble Brook.....	400
Gore Creek.....	10,000	Merwin Brook.....	300
Montrose, Spring Creek.....	15,000	West Aspatuck River.....	3,200
Swanson Lake.....	1,000	Plantsville, Plants Pond.....	200
Nast, Cunningham Creek.....	2,500	Simsbury, Bissell Brook.....	250
Frying Pan River.....	55,000	Salmon Brook.....	250
Frying Pan River, South Fork.....	25,000	Southington, Vlasto's pond.....	400
Ivanhoe Creek.....	5,000	Williamantic, Applicant.....	*2,000
Norrie, Chapman Creek.....	15,000	Mount Hope River, West Branch.....	1,200
Chapman Lake.....	30,000	Norman Clark Brook.....	14,000
Frying Pan River.....	30,000	{	
Olathe, Heckert's lake.....	15,000	Georgia: Tallulah Falls, Tallulah River.....	
Ouray, Dallas Club Lake.....	3,000	1,000	
Pando, Eagle River.....	75,000	Idaho:	
Parkdale, Arkansas River.....	37,000	Lenore, Trout Lake.....	300
Phillipsburg, Walton Creek Lake.....	20,000	Spencer, Indian Springs Pond.....	300
Prospect, Lily Lake.....	10,000	Wallace, Big Creek.....	1,000
Mountain View Lake.....	20,000	Coeur d'Alene River, North Fork.....	1,600
Wood Creek.....	5,000	Frazier Creek.....	800
Red Cliff, Homestake Creek.....	15,000	Placer Creek.....	1,000
		Slate Creek.....	1,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Illinois: Spring Grove, State fish commission.....	*50,000	Maine—Continued.	
Indiana:		Jackman, Little Churchill Creek.....	†16,000
Elkhart, Heaton Lake Creek.....	†15,000	Little Turner Pond.....	†12,000
Hobart, Duck Creek.....	†10,000	Little Wood Pond.....	†8,000
Michigan City, Cowin Brook.....	†10,000	Long Pond.....	†24,000
Spring Brook.....	†10,000	Lost Pond.....	†12,000
Wabash, Swank Creek.....	†20,000	Luther Pond.....	†12,000
Iowa:		Moores Pond.....	†8,000
Cresco, Baldwin Creek.....	1,000	Moose River.....	†32,000
Rutherford Creek.....	1,000	Moses Holden Pond.....	†8,000
Spirit Lake, State fish commission..	*50,000	Newton Pond.....	†12,000
Maine:		Rancourt Pond.....	†8,000
Attean, Attean Lake.....	†9,000	Sandy Stream.....	†8,000
Clearwater Pond.....	†9,000	Smith Pond.....	†8,000
Moose Pond.....	†9,000	Stony Brook.....	†8,000
Toby Pond.....	†9,000	Sugar Berth Pond.....	†12,000
Williams Brook.....	†9,000	Supply Pond.....	†8,000
Bar Mills, Silver Brook.....	†28,000	Three Streams.....	†8,000
Belfast, St. Georges Lake.....	†30,000	Whipple Pond.....	†8,000
Bingham, Decker Ponds.....	1,500	Kennebago, Johns Pond.....	1,975
Blanchard, Bunker Pond.....	†8,000	Kennebago Lake.....	3,000
Bluehill Falls, Motherbush Pond.....	2,000	Little Kennebago Lake.....	1,975
Castine, Fresh Pond.....	3,000	Kineo, Moose River.....	†24,000
Columbia Falls, Peaked Mountain Pond.....	†21,000	Scotean River.....	†15,000
Dedham, Branch Pond.....	†50,000	Tomhegan River.....	†12,000
Dexter, Jumper Brook.....	†6,000	Kingfield, Day Brook.....	†17,500
Lake Wassookeag.....	†27,000	Tufts Pond.....	†17,500
Pitts Brook.....	600	Lincolns Mills, Alder Brook.....	600
Puffer Pond.....	†15,000	McGeorges Siding, Cathance Lake..	†28,000
Eagle Lake, Eagle Lake.....	†114,000	Machias, Simpson Pond.....	†28,000
Square Lake.....	†57,000	Monmouth, Purgatory Lake.....	2,000
East Orland, Craig Pond.....	{ 50,000	Tacoma Lake.....	2,000
Gully Brook.....	{ 2,500	North Anson, Embden Pond.....	2,000
Patten Pond.....	{ 15,000	Norway, Virginia Lake.....	1,600
Wardwell Brook.....	{ 16,000	Old Orchard, Mansion House Pond..	†7,000
Ellsworth, Branch Pond.....	{ 500	Oquossoc, State fish commission....	*100,000
Ellsworth Falls, Beech Hill Pond....	†15,000	Otis, Green Lake.....	†102,676
Enfield, Trout Pond.....	†12,000	Patten, Green Pond.....	†21,000
Grand Lake Stream, Bonny Brook....	†5,000	Hale Pond.....	†21,000
Gardner Brook.....	†3,600	Pleasant Lake.....	†21,000
Spring Brook.....	†5,000	Tote Road Pond.....	†15,000
Sunset Brook.....	†10,000	Phillips Lake, Phillips Lake.....	†50,000
Green Lake, Green Lake.....	†70,000	Portage, Portage Lake.....	†36,000
Harmony, Grant Brook Pond.....	†21,000	Portland, Beaver Brook.....	†7,000
Harrington, Schoodic Pond.....	†14,000	Brandy Brook.....	†10,500
Hinckley, Lake George.....	†21,000	Clydale Pond.....	†17,500
Holeb, Barrett Pond.....	†15,000	Highland Lake, tributaries of	
Bog Brook.....	†15,000	North Branch.....	†10,500
Deer Pond.....	†16,000	Little River.....	†10,500
Indian Pond.....	†6,000	Nonesuch River.....	†21,000
Lowell Pond.....	†10,000	Pleasant River.....	†17,500
Moose River.....	†50,000	Red Brook.....	†10,500
Holden, Hatcase Pond.....	†30,000	Princeton, Huntley Brook.....	†17,500
Island Falls, Pleasant Pond.....	†18,000	Saco, Boothby Brook.....	†14,000
Jackman, Attean Lake.....	†12,000	Boytton Brook.....	†14,000
Benjamin Pond.....	†8,000	Burham Brook.....	†17,500
Big Churchill Creek.....	†12,000	Deep Brook.....	†21,000
Big Turner Pond.....	†8,000	Foxwell Brook.....	†14,000
Bog Pond.....	†16,000	Fresh Water Brook.....	†17,500
Boulder Pond.....	†8,000	Goose Fair Brook.....	†21,000
Campbell Pond.....	†3,000	Harmon Brook.....	†14,000
Clearwater Pond.....	†8,000	Holmes Brook.....	†14,000
Coburn Pond.....	†12,000	Kay Brook.....	†10,500
Crocker Pond.....	†16,000	Lord Brook.....	†14,000
Diamond Pond.....	†12,000	Meade Brook.....	†17,500
First Toby Pond.....	†12,000	Murch Brook.....	†14,000
Gander Brook.....	†12,000	Ricker Brook.....	†14,000
Grace Pond.....	†8,000	Sandy Brook.....	†14,000
Halfway Pond.....	†16,000	Stuart Brook.....	†14,000
Heald Creek.....	†12,000	Searsport, Swan Lake.....	†27,000
Horse Brook.....	†12,000	South Berwick, Knights Pond.....	†10,500
Horseshoe Pond.....	†8,000	South Paris, Concord River.....	†17,500
Jim Mack Pond.....	†12,000	Shagg Pond.....	2,000
Little Big Wood Pond.....	†16,000	Washburn Pond.....	†7,000
		South Penobscot, Fourth Pond.....	1,500
		Wights Pond.....	3,000
		Waldoboro, Slaigo Brook.....	2,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Maine—Continued.		Massachusetts—Continued.	
Walkers, Blackwater Brook.....	{ 19,000	Wellsley Farms, Indian Spring	2,400
Squa Pan Brook.....	{ 2,000	Westboro, Cedar Brook.....	5,000
Squa Pan Lake.....	{ 16,000	Westfield, Big Powder Mill Creek.....	5,000
Waterville, Britton Lake.....	{ 2,000	Great Brook.....	7,000
West Ellsworth, Patten Pond.....	{ 139,000	Jacks Brook.....	2,000
Whitneyville, Arna Meadow Brook.....	{ 130,000	Little Powder Mill Brook.....	2,000
Maryland:	{ 75,000	Little River.....	7,900
Baltimore, Applicant.....	{ 110,500	Loomis Street Brook.....	7,000
Cumberland, Flintstone Creek.....	{ 3,600	Manhan River.....	8,000
Deer Park, Glade Run.....	{ 1,000	Potash Brook.....	2,000
Frostburg, Big Shade Run.....	{ 800	Reservoir Brook.....	2,000
Big Laurel Run.....	{ 800	Roaring Brook.....	2,000
Little Shade Run.....	{ 800	Sandy Mill Brook.....	2,000
Puzzley Run.....	{ 800	Michigan:	
Spiker Run.....	{ 800	Baldwin, Baldwin Creek and	
Germantown, Jones Creek.....	{ 612	Branches.....	120,000
Glen Echo, Little Paint Branch.....	{ 500	Bessemer, Massie Run.....	1,500
Hagerstown, Lanes Run.....	{ 1,800	Beulah, Cold Creek.....	8,000
Leitersburg Run.....	{ 2,000	Branch, Weldon Creek.....	120,000
Stakes Run.....	{ 3,000	Chassell, Paradise Brook.....	1,500
Lonaconing, Browns Run.....	{ 1,200	Copemish, Betsey River.....	8,000
Mountain Lake Park, Little Yough-		Covington, Case Creek.....	1,500
ogheny River.....	2,400	Dreher Creek.....	1,500
Oakland, Black Run.....	400	Rock Creek.....	1,500
Bradley Run.....	400	Watson Creek.....	1,500
Browning Pond.....	1,600	Crystal Falls, Briar Hill Creek.....	1,500
Elk Lick Run.....	1,170	Brule Lake.....	3,000
Folly Run.....	1,170	Lower Deer River.....	3,000
Glade Run.....	800	Daggett, Johnson Creek.....	3,000
Herrington and Kessner Run.....	400	East Tawas, Au Sable River.....	150,000
Lake Beulah.....	400	Indian Creek.....	120,000
Murley Brook.....	1,600	Loud Creek.....	120,000
North Cherry Creek.....	800	Vaughn Creek.....	120,000
Toliver Run.....	400	Farwell, Chippewa River and	
Totten Run.....	540	branches.....	120,000
Wilson Run.....	800	Hillman, Brush Creek.....	15,000
Rockville, Lakes Brook.....	1,000	Bullock Creek.....	30,000
Massachusetts:		Pike Creek.....	5,000
Barre, Gaston's pond.....	2,500	Houghton, Poppy Creek.....	3,000
Clinton, Bowers Brook.....	1,500	Indian River, Little Pigeon River.....	150,000
Burkes Brook.....	1,500	Twin Lake Branch.....	150,000
Collins Brook.....	3,400	Iron River, McColman Creek.....	1,500
Cushman, Roaring Brook.....	16,000	McAllister Creek.....	1,500
Hartsville, Konkapot River.....	82,000	Silver Creek.....	1,500
Hinsdale, Knapp Brook.....	2,000	Ishpeming, Clear Water Creek.....	6,000
Stevens Creek.....	5,000	Gold Mine Creek.....	5,000
Kingston, Furness Brook.....	6,000	Green Creek.....	11,000
Lee, East Beartown Brook.....	1,000	Peshekeeme River.....	16,000
East Lee Brook.....	1,000	West Branch.....	6,000
Hopp Brook.....	1,000	Jackson, Crouches Creek.....	125,000
Peggy Brook.....	1,000	Kingsley, East Creek.....	120,000
Stockbridge Lake.....	300	Grays Creek.....	120,000
Tyringham Brook.....	1,000	Lake Gerald, Little Elm Creek.....	1,500
Washington Brook.....	2,000	Lake Linden, Chantonaw Creek.....	1,500
West Beartown Brook.....	1,000	Dreamland Creek.....	1,500
Leominster, Fall Brook.....	10,000	Spring Brook.....	1,500
Spectacle Pond.....	5,000	Leo Siding, Kelsey Creek.....	1,500
Pittsfield, Furnace Brook.....	1,000	Lucas, Clam River.....	8,000
Sackett Brook.....	1,000	McBains, Clam River.....	8,000
Town Brook.....	1,000	Marenisco, Alder Creek.....	1,500
Yokum River.....	1,000	Ash Creek.....	1,500
Shelbourne Falls, Avery Brook.....	15,000	Balsam Brook.....	1,500
Basset Brook.....	15,000	Barrs Brook.....	1,500
Bear River.....	15,000	Bear Creek.....	1,500
Branch Creek.....	15,000	Beaver Brook.....	1,500
Clark Brook.....	15,000	Birch Creek.....	1,500
Clesent River.....	15,000	Cedar Creek.....	1,500
Dragon Brook.....	15,000	Clam Creek.....	1,500
Drake Brook.....	14,000	Dandy Browns Brook.....	1,500
Fox Brook.....	13,000	Douglass Creek.....	1,500
Hawks Brook.....	15,000	Foleys Creek.....	1,500
Mill River.....	15,000	Forbs Brook.....	1,500
North River.....	14,500	Fosters Brook.....	1,500
Schneck Brook.....	14,000	Fox Creek.....	1,500
Steel Brook.....	14,000	Fur Creek.....	1,500
Wilcox Brook.....	13,000	Hazel Creek.....	1,500
Wilder Brook.....	14,000	Hoffman Creek.....	1,500
Tyngsboro, Butterfield Pond.....	3,000	Honeymoon Creek.....	1,500
		Iron Creek.....	1,500



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Michigan—Continued.		Minnesota—Continued.	
Marenisco, Jimmie Thomas Brook.	1,500	Houston, Storer Valley Creek.	850
Jones Brook.	1,500	Swede Bottom Creek.	850
Lemon Creek.	1,500	Knife River, Baptism River.	8,000
Little Coon Creek.	1,500	Manitou River.	15,000
Little Spring Creek.	1,500	Temperance River.	8,000
McKinney Creek.	1,500	Larsmont, Launsberry's pond.	2,000
Mays Creek.	1,500	Lewiston, Enterprise Creek.	1,400
Munroe Creek.	1,500	Ferguson Creek.	700
Nine Mile Creek.	1,500	Hemingway Creek.	1,400
Otter Creek.	1,500	Pine Creek.	1,400
Pigeon Creek.	1,500	Little Falls, Skunk Creek.	4,500
Rowe Creek.	1,500	Pickwick, Trout Creek.	124,000
Ryan Creek.	1,500	Pillager, Peterson Creek.	3,000
Sampson Creek.	1,500	Rochester, Badger Creek.	1,400
Schamel Creek.	1,500	Bear Creek.	1,400
Slippery Elm Creek.	1,500	Trout Creek.	700
Stabler Creek.	1,500	Rushford, Big Spring Creek.	850
Sutherland Creek.	1,500	Birchdale Creek.	850
Tamarack Creek.	1,500	Camp Creek.	850
Triplett Creek.	1,500	Collridge Creek.	850
Wenzel Creek.	1,500	Daley Creek.	850
Willow Creek.	1,500	Diamond Creek.	850
Marion, Clam River.	8,000	Enterprise Creek.	850
Mass, Fire Steel River.	6,000	Ferguson Creek.	850
Metropolitan, Sturgeon Creek, West Branch.	3,000	Ferndale Creek.	850
Negaunee, Escanaba River.	10,000	Gaffney Spring Creek.	850
Spring Creek Pond.	2,000	Gribbin Creek.	850
Ten Kiln Creek.	5,000	Hazard Creek.	850
Niles, Dowagiac Creek.	10,000	Hemmingway Creek.	850
McCoy Brook.	6,000	Iverson Creek.	850
Walton Brook.	4,000	Jensen Creek.	850
Nirvana, Pere Marquette River and branches.	120,000	Mende Creek.	850
Ontonagon, Cranberry River.	7,500	Opheim Creek.	850
Cunningham Creek.	3,000	Overland Creek.	850
Deer Creek.	3,000	Pine Creek.	850
Paddy Creek.	1,500	Rush Creek.	1,700
Perch Siding, Cold Creek.	1,500	Silver Creek.	850
Perch River.	1,500	Torkelson Creek.	850
Pori, Leveque Creek.	3,000	Vigland Creek.	850
Raco, Pine River, tributaries of.	12,000	Wiscow Creek.	1,700
Rockland, Flintsteel River.	4,500	St. Charles, Campbell Creek.	1,200
Rockland Creek.	3,000	Carter Creek.	600
Rock River, Rock River.	8,000	Crow Creek.	1,200
Stager, Nault Creek.	1,500	Culbertson Creek.	600
Stager Creek.	3,000	Demuth Creek.	1,200
Stephenson, Belgey Brook.	3,000	Drakes Creek.	1,200
Stonington, Lake Grace.	3,000	Fays Creek.	600
Tioga Siding, Hickey Creek.	3,000	Ferguson Creek.	600
Wellston, Cedar Creek.	115,000	Hemmingway Creek.	1,200
Pine Creek.	140,000	Hendee Creek.	600
Wingleton, Bauman and Cedar Creeks.	120,000	Holms Creek.	1,200
Yuma, Slagle Creek.	130,000	Holtz Creek.	1,200
Minnesota:		Logan Branch.	1,200
Byron, Bear Creek.	4,900	Loudens Creek.	600
Caledonia, Crooked Creek, South Fork.	480	Nichols Creek.	600
Crystal Valley Creek.	480	Pettis Creek.	1,800
Dexter Creek.	480	Pfeils Creek.	600
Thompson Creek.	480	Pine Creek.	600
West Beaver Creek.	480	Quincy Creek.	1,200
Winnabago Creek.	480	Rush Creek.	600
Clearbrook, Clearbrook Creek.	10,000	Slarins Creek.	600
Ruffy Brook.	16,000	Trout Creek.	1,800
Fairbanks, Wolf Creek.	8,000	Troy Creek.	1,200
Harmony, Elliott Creek.	2,550	Whitewater River.	600
Maland Creek.	850	Whitewater River, Middle Branch.	1,800
Morem Creek.	850	Whitewater River, North Branch.	1,200
Houston, Badger Creek.	850	Whitewater River, South Branch.	1,200
Bridge Creek.	850	Wilson Branch.	600
Campbell Creek.	850	Sugar Loaf, Pleasant Valley Creek.	16,000
Daily Creek.	850	West Burns Creek.	110,500
East Beaver Creek.	850	Winona, Beaver Creek.	1,000
Crystal Valley Creek.	850	Conedale Creek.	2,000
Looney Valley Creek.	850	Gilmore Valley Pond.	1,200
Money Creek.	850	Willow Pond.	1,200
		Montana:	
		Alder, Rubey River.	900
		Arlee, Agency Creek.	675
		Finley Creek.	1,675

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Montana—Continued.</b>		<b>Nebraska:</b>	
Arlee, Jocko River.....	3,500	Chadron, Beaver Creek.....	800
Spring Creek.....	1,450	Big Bordeaux Creek.....	1,200
Belgrade, Benhart Creek.....	4,000	Chadron Creek.....	800
Bull Creek.....	5,000	Dead Horse Creek.....	800
Cottonwood Creek.....	4,000	East Ash Creek.....	3,750
Cowen Creek.....	4,000	Indian Creek.....	4,550
Dry Creek.....	11,000	Little Bordeaux Creek.....	800
East Gallatin River.....	9,000	Trunk Butte Creek.....	800
Middle Creek.....	12,000	Gordon, Larabee Creek.....	1,500
Pass Creek.....	5,000	Larver Creek.....	1,500
Reese Creek.....	6,000	White Clay Creek.....	4,750
Ross Creek.....	7,000	Rushville, White Clay Creek.....	4,750
Story Creek.....	5,000	<b>Nevada:</b>	
Thompson Creek.....	5,000	Ely, Applicant.....	*50,000
Big Timber, Coulee Creek, North Fork.....	3,500	Sparks, Rodeo Creek.....	1,500
Browning, Arnoux Creek.....	1,200	Verdi, State fish commission.....	*150,000
Milk River, Middle Fork.....	2,000	<b>New Hampshire:</b>	
Choteau, Sun River.....	1,600	Bartlett, Saco River.....	†15,000
Darby, Bitter Root River.....	600	Bennington, Lake George.....	4,000
Dell, Red Rock River.....	2,000	Spring Pond.....	4,000
Sheep Creek.....	2,000	Willard Pond.....	3,000
Dodson, Lodge Pole Creek.....	2,000	Bowman, Moore River.....	†12,000
East Bridges, Chain of Lakes.....	2,600	Bristol, Brayley Brook.....	6,000
Florence, Three Mile Creek.....	1,200	Cockermouth River.....	10,000
Forest Grove, Flatwillow Creek, West Fork.....	1,200	Dick Brown Brook.....	8,000
McCartney Creek.....	600	Pemegawasset River.....	10,000
Surenough Creek.....	600	Smith River.....	10,000
Glacier Park, Cutbank River.....	2,000	Ten Mile Brook.....	8,000
Grinnell Lake.....	2,000	Campton, West Branch.....	3,000
Gunsight Lake.....	2,000	Canaan, Barney Pond.....	20,000
Lake Josephine.....	2,000	Blodgett Pond.....	3,000
Lake Mary Ellen Wilson.....	2,000	Clark Pond.....	3,000
Red Eagle Lake.....	2,000	Conrow Brook.....	3,000
St. Marys Lake.....	3,000	Cummings Pond.....	4,000
Hamilton, Spring Creek.....	15,000	Currier Brook.....	2,500
Havre, Beaver Creek.....	400	Davis Brook.....	1,000
Hedges, Careless Creek.....	2,000	Fairweather Brook.....	8,000
Swimming Woman Creek.....	2,000	Ford Brook.....	2,000
Hobson, Springdale Creek.....	3,000	Gulf Brook.....	3,000
Lewistown, Castle Creek.....	450	Hames Brook.....	7,000
Lake Paradise.....	750	Hart Pond.....	4,000
Marquette River.....	11,000	Indian Brook.....	15,000
Spring Creek, East Fork.....	10,800	Kilton Brook.....	2,000
Martinsdale, Basin Creek.....	10,000	Kimball Brook.....	10,000
Richmond Creek.....	10,000	Moose Brook.....	2,000
Missoula, Browns Lake.....	1,800	Murray Brook.....	2,000
Dusett Creek.....	675	Orange Brook.....	16,000
Kleinsmith Lake.....	1,575	Powers Brook.....	1,000
Rattlesnake Creek.....	1,800	Sawyer Brook.....	2,000
Moccasin, Louise Creek.....	3,000	Story Brook.....	1,000
Norris, North Meadow Creek.....	20,000	Cherry Mountain, Isreal River.....	†9,000
South Meadow Creek.....	12,000	Concord, Jordan Pond.....	1,000
Pony, South Willow Creek.....	13,000	One Stack Brook.....	2,500
Red Lodge, Red Lodge Creek.....	4,900	Enfield, Lovejoy Brook.....	4,000
Rock Creek, West Fork.....	2,200	Fabyan, Abenaki Brook.....	†2,000
Red Rock, Spring Branch.....	300	Ammonoosue River.....	†18,000
Roundup, Swimming Woman Creek.....	3,000	Asquam Brook.....	†2,000
Springhill, Ross Creek.....	1,200	Black Brook.....	†3,000
Stevensville, Charette Creek.....	8,000	Clay Brook.....	†2,000
Sweet Grass, Deer Creek.....	800	Clinton Brook.....	†3,000
Townsend, Confederate Creek.....	1,000	Crawford Brook.....	†4,000
Crow Creek.....	1,250	Deception Brook.....	†2,000
Victor, Lake View.....	2,000	Jefferson Brook.....	†3,000
White Sulphur Springs, Battle Creek.....	6,000	Lake Anderson.....	†4,000
Beaver Creek.....	9,000	Lake Carolyn.....	†3,000
Big Birch Creek.....	8,000	Mount Echo Brook.....	†3,000
Big Spring Creek.....	7,000	Sebossis Brook.....	†3,000
Cammas Creek.....	6,500	Twin River.....	†3,000
Lake Creek.....	4,000	Glen, Ellis River.....	†9,000
Musselshell River, North Fork.....	9,000	Glen Cliff, Funnell Brook.....	†3,000
Newlan Creek.....	6,000	Oliverian Brook.....	†3,000
Smith River, South Fork.....	9,000	Witcher Brook.....	†3,000
White Tail Creek.....	6,500	Gorham, Wild River.....	†18,000
Winston, Antelope Creek.....	1,000	Grafton, Sanders Brook.....	2,000
Staback Creek.....	1,000	Greenfield, Alexander Brook.....	2,000
		Cooper Brook.....	3,000
		Hardy Brook.....	6,000
		Harrington Brook.....	4,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
New Hampshire—Continued.		New Hampshire—Continued.	
Greenfield, Hovey Brook.....	3,000	West Rindge, Taggart Brook.....	6,000
Jarlyn Branch.....	4,000	Wilton, Blood Brook.....	4,000
Lawn Brook.....	3,000	Hodgdon Brook.....	4,000
Newton Brook.....	3,000	Wing Road, Gale River.....	†12,000
Smith Brook.....	3,000	Woodstock, Eastman Brook.....	6,000
South Brook.....	2,000	New Jersey:	
Young Brook.....	2,000	Englewood, Ditman's pond.....	800
Henniker, Aime Brook.....	10,000	East Northvale Brook.....	500
Brown Brook.....	4,000	Hutchinson Pond.....	500
Hill, Borough Brook.....	200	Leonia, Egli's pond.....	500
Flanders Brook.....	5,000	Oak Ridge, Stony Brook.....	750
Knox Brook.....	200	Stony Brook Lake.....	2,000
Rowell Brook.....	200	Paterson, Saw Mill Brook.....	2,000
Woodward Pond.....	8,000	Phillipsburg, Lows Hollow Creek.....	1,000
Keene, Granite Lake.....	8,000	Mill Brook.....	1,000
Great Brook.....	5,000	Rockaway, Beaver Brook.....	2,400
White Brook.....	8,000	New Mexico:	
Lebanon, Chamberlain Brook.....	2,000	Cloudcroft, Water Canyon Creek.....	1,500
Great Brook.....	11,000	Dexter, Pecos River.....	1,000
Hibbard Brook.....	9,000	Espanola, Quemado Creek.....	1,000
Smith Brook.....	1,500	Rio Amadia.....	1,000
Smith Pond.....	14,000	Santa Clara River.....	1,000
Stoney Brook.....	12,000	Truckas Creek.....	1,000
Littleton, Glover's pond.....	†4,000	Folsom, Canyon Creek.....	1,500
Manchester, Bog Brook.....	3,000	Glorieta, Holy Ghost Creek.....	5,000
Cold Brook.....	10,000	Macho Creek.....	2,000
Cold Stream Brook.....	6,000	Moro Creek.....	3,500
Darrah Brook.....	4,000	Pecos River.....	9,000
Hodgedon Brook.....	15,000	Willow Creek.....	1,000
Leach Brook.....	10,000	Winsor Creek.....	2,500
McQuestion Brook.....	2,000	Hagerman, Felix River.....	500
Mill Stone Brook.....	2,000	Lamy, Pecos River.....	7,500
Nigger Brook.....	1,000	Las Vegas, Gallinas River.....	6,000
Patten Brook.....	10,000	Gallinas River, South Fork.....	2,000
Peters Brook.....	300	Gallinas River, Trout Spring	
Pierce Brook.....	24,000	Branch.....	1,000
Ray Brook.....	2,200	Gallinas River, Youngs Fork.....	1,000
Searches Brook.....	6,000	Sapello River.....	1,000
South Wear Brook.....	8,000	Raton, East Royale River.....	7,000
Stark Brook.....	15,000	Schwachheim Creek, Left Fork.....	2,500
Sweet Water Brook.....	2,000	Schwachleime Creek, Right	
Thompson Brook.....	2,000	Fork.....	2,500
Whiting Brook.....	11,000	Sugarite Creek.....	5,000
Willys Brook.....	2,000	Riberia, Pecos River.....	5,000
Woodward Brook.....	10,000	Taiban, Taiban Creek.....	500
Nashua, Bailey Brook.....	6,000	New York:	
Bartemus Brook.....	6,000	Altmar, Campbell Creek.....	†4,000
Beaver Brook.....	2,000	Grindstone Creek.....	†28,000
Budro Brook.....	10,000	Podunk Creek.....	†5,000
Crystal Spring Brook.....	4,000	Ardasley, Grassy Sprain Brook.....	†4,000
Glover Brook.....	1,500	Sprain Brook.....	†8,000
Hardy Brook.....	2,000	Attica, Holden Brook.....	†4,000
Lid Reed Brook.....	8,000	Java Center Creek.....	†3,000
Little Nesenkeag Brook.....	2,000	Johnson Creek.....	†2,000
Muddy Brook.....	4,000	Au Sable Forks, Taylor Pond.....	†8,000
Naticook Brook.....	8,000	Bath, Cold Spring Creek.....	†5,000
Nesenkeag Brook.....	10,000	Benson Mines, Ellis Creek.....	†5,000
Noyes's pond.....	8,000	Little River.....	†15,000
Peacock Brook.....	4,000	Tamarack Creek.....	†5,000
Peg Leg Brook.....	5,000	Brookhaven, Little Neck Run.....	†1,750
Stearns Brook.....	1,500	Cadosia, Vance Creek.....	1,000
Witch Brook.....	8,000	Callicoon, Callicoon Creek.....	†9,000
Newport, Rand Pond.....	1,000	Cambridge, McMillans Brook.....	†3,000
Shedd Brook.....	2,000	Carthage, Black Creek.....	†12,000
Stony Brook.....	8,000	Deerlick Creek.....	†3,000
North Woodstock, Eastman Brook.....	3,000	Draper Creek.....	†3,000
Jackman Brook.....	2,000	Hubbard Creek.....	†5,000
Lost River.....	2,000	Weaver Creek.....	†5,000
Pemigewasset River, Middle		White Creek.....	†3,000
Branch.....	2,000	Catskill, Whip-poor-will Brook.....	†3,000
Plymouth, Clay Brook.....	8,000	Cattaraugus, Boardman Creek.....	†3,000
Power's brook.....	8,000	Wallace Brook.....	†4,000
South Brookline, Rockwood Pond.....	4,000	Cobleskill, Adams Hollow Brook.....	†10,000
South Lyndeboro, Rose Mountain		Charlottesville Creek.....	2,000
Brook.....	3,000	Clapper Hollow Brook.....	†5,000
Suncook, Deer Brook.....	3,000	Cold Spring Brook.....	1,500
Hamshire Creek.....	3,000	East Worcester Creek.....	†12,000
Twin Mountain, Zealand River.....	†9,000	Tar Hollow Brook.....	1,000
Warren, State fish commission.....	*50,000	Conewango, Post Brook.....	†5,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
New York—Continued.		New York—Continued.	
Corning, Owens Pond.....	†4,000	Santa Clara, Guide Board Brook....	†5,000
Cortland, Fall Brook.....	5,000	Spring Pond.....	†2,000
Scott Brook.....	4,000	Schenectady, Hungerkill Creek.....	†9,000
Croghan, Fish Creek.....	†10,000	Schenevus, Elk Creek.....	†15,000
Sand Pond.....	†10,000	Sherburne, Handsome Brook.....	†20,000
Trout Brook.....	†5,000	Smyrna Brook.....	1,200
Delevan, Worden's pond.....	†4,000	Shohola, Beaver Brook.....	†10,000
Deposit, Cold Spring Brook.....	1,000	South Lansing, East Teeter Creek....	†6,000
Columbia Lake.....	2,000	Steinberg Creek.....	1,600
Oquaga Creek.....	2,000	Springville, Clarks Brook.....	†4,000
Rood Creek.....	1,000	Syracuse, Butternut Creek.....	1,200
Trout Creek.....	1,000	Chittenango Creek.....	1,600
Whitaker Creek.....	500	DeMont Frida Brook.....	†5,000
East Worcester, Baptist Church		Evansward Trout Pond.....	†5,000
Brook.....	†6,000	Limestone Creek.....	1,200
Clapper Hollow Brook.....	†5,000	Onondaga Creek.....	1,200
Tar Hollow Brook.....	†6,000	Pooles Brook.....	1,600
Ellenville, Beer Kill Creek.....	†9,000	Scriba Creek.....	2,000
Botsford Brook.....	†5,000	Walton, Beers Brook.....	†13,500
Elmira, Barfield Brook.....	†8,000	Bramley Brook.....	†5,000
Beaver Brook.....	†4,000	East Brook.....	†9,000
Catherine Creek.....	†8,000	Marvin Hollow Creek.....	†9,000
Jackson Creek.....	†8,000	West Brook.....	†13,500
Seeley Creek.....	†5,000	Watertown, Stebbins Creek.....	†15,000
Sing Sing Creek.....	†8,000	Westport, Birch Pond.....	500
Wyncoop Creek.....	†8,000	Bouquet River.....	500
Felts Mills, Felts Mill Creek.....	†10,000	Bouquet River, North Branch.....	500
Fulton, Black Creek.....	†16,000	Bouquet River, South Branch.....	500
Sheldons Creek.....	†5,000	Branch Brook, South Fork.....	500
Genoa, Gamel Creek.....	1,600	Club House Brook.....	500
Pine Hollow Creek.....	800	Cold Spring Brook.....	500
Great Bend, Hubbard Creek.....	†15,000	Courtney Pond.....	500
Halfway, Carpenter Brook.....	†10,000	Deep Hole Pond.....	500
Hornell, Car Valley Brook.....	†5,000	Finch Pond.....	500
Rockwell Brook.....	†5,000	Finch Pond Brook.....	500
Seely Creek.....	†10,000	Ledge Brook.....	500
Hunter, Batavia Kill Creek.....	†8,000	Lindsay Brook.....	500
Big Hollow Creek.....	†8,000	Miller Camp Brook.....	500
Nauvoo Creek.....	†6,000	Moss Pond.....	1,500
LaFargeville, Landon Creek.....	†4,000	Moss Pond Brook.....	500
Lake Mahopac, Croton River, West		Schroon River.....	500
Branch.....	†21,000	Secret Pond.....	500
Liberty, Mongaup Creek.....	1,000	White Plains, Fowler Pond.....	300
Limestone, Quaker Creek.....	3,000	North Carolina:	
Long Lake West, Otter Pond.....	†5,000	Andrews, Morris Creek.....	2,000
Lyons, Ackerman Brook.....	1,200	Asheville, Dillingham Creek.....	2,500
Glenmont Brook.....	1,200	Bowie, Cauchee Creek.....	3,000
Mudge Creek.....	1,600	Brevard, Hubbard Creek.....	4,000
Rose Creek.....	1,200	Williamson Creek.....	8,000
Morrisville, Cowasselon Run.....	†3,500	Cherryfield, Bear Wallow Creek.....	3,000
Oneida Creek.....	†3,500	Cherryfield Creek.....	3,000
Mount Kisco, Beaverdam Creek.....	†17,500	Mill Creek.....	3,000
Newark, Trout Creek.....	†15,000	Paxton Creek.....	3,000
North Hion, Gulf Creek.....	†18,000	Doughton, Sandy Creek.....	3,000
North Lansing, Gulf Creek.....	800	Edgemont, Wilson Creek.....	5,000
Teeter Creek.....	400	Elkland, Greens Mill Creek.....	1,500
Northville, Charley Lake.....	†5,000	Hartley Creek.....	1,500
Ononota, Charlotte River.....	†20,000	Howards Creek.....	2,000
Oswego, Lewis Creek.....	†10,000	Flat Rock, Kings Creek.....	2,000
Port Henry, Cheney Pond.....	†10,000	Graphiteville, Mill Creek.....	2,000
Sand Pond.....	†5,000	Lake Toxaway, Bear Wallow	
Port Jervis, Black Brook.....	†5,000	Creek.....	6,000
Burnt Hope Creek.....	†6,000	Chatoga River.....	10,000
Bush Kill Creek.....	†6,000	Fowler Creek.....	4,000
Mongaup River.....	†10,000	Green Creek.....	4,000
Shinglekill Creek.....	†8,000	Miller's pond.....	4,000
Stenneykill Creek.....	†4,000	Thompson Lake.....	4,000
Potsdam, Snell Brook.....	†10,000	Lenoir, Davenport Branch.....	2,000
Preble, Tioughoga River.....	1,000	Linville, Big Grassy Creek.....	5,000
Randolph, Prosser Pond.....	†7,000	Grandmother Creek.....	10,000
Raquette Lake, Applicant.....	*25,000	Laurel Creek.....	5,000
Bear Pond.....	*25,000	Linville River.....	5,000
Richland, Mad River, West Branch.	†10,000	Linville River, West Fork.....	5,000
Salmon River, North Branch.....	†13,000	Little Grassy Creek.....	4,000
Rome, Fish Creek.....	†27,000	Marion, Little Buck Creek.....	2,000
Mohawk River.....	2,800	Mount Mitchell, Crab Tree Creek....	300
Santa Clara, Deep Pond.....	†2,000	Old Fort, Curtis Creek.....	5,000
Deer Pond.....	†2,000	Jarrett Creek.....	2,000
Dimmerick Brook.....	†4,000	Mackey Creek.....	2,000
		Swannanoa River.....	2,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
North Carolina—Continued.		Pennsylvania—Continued.	
Olivette, Mulberry Creek.....	2,000	Cherry Tree, Brush Run.....	600
Pineola, Barrier Creek.....	450	Chesterbrook, Valley Creek.....	1,200
Cranberry Creek.....	200	Valley Creek, South Branch.....	1,200
Linville River.....	975	Clarks Summit, Williams Creek.....	800
Pisgah Forest, Davidson River and tributaries.....	42,000	Clearfield, Albert Run.....	1,000
Rosman, Bear Wallow Creek.....	2,000	Alder Run.....	2,000
Bowen Works Creek.....	3,000	Anderson Creek.....	600
Bowing Creek.....	5,000	Baughman Run.....	1,000
East Fork Creek.....	6,000	Bear Wallow Run.....	1,000
French Broad River, East Fork.....	6,000	Big Lick Run.....	3,000
French Broad River, Middle Fork.....	5,000	Big Lick Run, Left Branch.....	1,000
Gabbies Branch.....	2,000	Big Lick Run, Right Branch.....	1,000
Walkers Creek.....	3,000	Big Lick Run, Shaws Branch.....	1,000
Saluda, Fall Creek.....	1,000	Birch Run.....	2,000
Selica, Cantrell Creek.....	4,000	Bish Run.....	1,000
Shulls Mills, Boone Fork Creek.....	15,000	Blooms Run.....	1,600
Watauga River.....	8,000	Bowman Run.....	1,000
West Jefferson, Peak Creek.....	2,000	Butler Run.....	1,000
Prather Creek.....	2,000	Campoke Run.....	2,000
Ohio:		Chase Run.....	1,000
Akron, Cuyahoga River.....	19,000	Coal Creek.....	600
Cuyahoga River, tributaries of.....	13,000	Coupler Run.....	2,300
Little Cuyahoga River.....	16,000	Crooked Run.....	1,300
Madison, Grand River.....	120,000	Debeck Run.....	1,000
Paden City, Kays Creek.....	120,000	Dixon Run.....	2,000
Urbana, Cedar Creek.....	110,000	Doctor Fork Run.....	1,000
Youngstown, Mill Creek.....	115,000	Downey Run.....	1,000
Oregon:		Eberts Run.....	1,000
Clackamas, Molalla Creek.....	32,000	Fork Run.....	3,300
Liberal, Molalla River.....	15,000	Garden Draft Run.....	1,000
Molina, Mill Creek.....	20,000	Gordon Run.....	1,000
Noti, Long Tom River.....	5,000	Gum Swamp Run.....	1,000
Pennsylvania:		Haines Run.....	1,000
Altoona, Blair Creek.....	20,000	Hampton Run.....	1,000
Ashland, Dyers Run.....	500	Haney Run.....	1,000
Roaring Creek.....	1,000	Horton Hollow Run.....	1,000
Boiling Springs, Boiling Springs Pond.....	1,500	Irwin Run.....	1,000
Bradford, Chapple Fork Run.....	1,200	Kephart Run.....	1,000
Quaker Run.....	1,200	Kline Run.....	1,000
Sugar Run.....	1,200	Laying Rock Run.....	1,000
Tuna Creek, East Branch.....	1,200	Lick Run.....	4,600
Tuna Creek, West Branch.....	1,200	Littel Run.....	1,000
Willow Creek.....	1,200	Little Coupler Run.....	1,000
Canton, Biddle Creek.....	12,000	Little Montgomery Creek.....	3,000
Braham Creek.....	12,000	Little Moose Creek.....	1,000
Coons Creek.....	12,000	Little Stony Creek.....	300
Fellows Creek.....	12,000	Low Run.....	1,000
Little Schrader Creek.....	12,000	Mease Run.....	1,000
Lye Run.....	12,000	Merrits Run.....	1,000
Lye Run, West Branch.....	12,000	Montgomery Creek.....	600
Mill Creek.....	12,000	Moose Creek.....	2,600
Pine Swamp Run.....	12,000	Morgan Run.....	3,000
Rathbone Creek.....	12,000	Ogden Run.....	1,000
Rock Run.....	12,000	Pine Hollow Run.....	1,000
Schrader Creek.....	12,000	Pine Swamp Run.....	1,000
South Creek.....	12,000	Raccoon Run.....	2,000
Spring Brook.....	12,000	Rattlesnake Run.....	1,000
Sugarworks Run, East Branch.....	12,000	Red Run.....	1,000
Sugarworks Run, West Branch.....	12,000	Reeds Run.....	1,000
Taber Creek.....	12,000	Rock Run.....	1,000
Tioga River.....	12,000	Sam Reed Run.....	1,000
Towanda Creek.....	12,000	Sanborn Run.....	2,000
Watkins Creek.....	12,000	Sandy Run.....	1,000
Whitehead Creek.....	12,000	Selfridge Run.....	1,000
Williams Hollow Creek.....	12,000	Singletree Run.....	1,000
Wilson Creek.....	12,000	Spruce Island Run.....	1,000
Carlisle, Yellow Breeches Creek.....	1,500	Stone Run.....	2,600
Cedar Hollow, Valley Creek.....	1,200	Stone Hammer Run.....	1,000
Valley Creek, South Branch.....	1,200	Stone Quarry Run.....	1,000
Chambersburg, Caledonia Creek.....	5,500	Stony Battery Run.....	1,000
Carbaugh Run.....	4,000	Stoneville Run.....	1,000
Furnace Dam.....	3,000	Stott Run.....	1,000
Bine Run.....	5,500	Surveyor Run.....	300
Raccoon Creek.....	3,500	Tarkill Run.....	1,000
Sanatarium Lake.....	1,000	Thompson Read Run.....	1,000
Solenberger Lake.....	2,500	Trout Run.....	600
Solenberger Run.....	1,500	Walker Run.....	1,000
		Walnut Hollow Run.....	1,000
		Whitney Run.....	2,600

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		Pennsylvania—Continued.	
Clearfield, Wilder Swamp Run.....	1,000	Glen Union, Benjamin Run.....	1,200
Wiser Run.....	1,000	Glendening Run.....	1,200
Witch Hazel Run.....	1,000	Cold Fork Run.....	600
Woods Run.....	2,300	Crabapple Run.....	600
Coudersport, Allegheny River, Head-		Cranberry Run.....	600
waters.....	1,500	Phants Run.....	600
Chapel Run.....	500	Rocky Fork Run.....	600
Dingman Run.....	500	Shoemaker Run.....	1,200
Dingman Run, East Branch.....	500	Water Plug Run.....	600
Dingman Run, West Branch.....	500	Gouldsboro, Bell Meadow Creek.....	800
Kline Hollow Creek.....	500	Lehigh River, Headwaters.....	1,200
Lehman Run.....	500	Harrison Valley, Bloomers Run.....	500
Mill Creek.....	1,000	Blue Coat Run.....	500
Nelson Run.....	500	Byam Run.....	500
Nelson Run, East Branch.....	500	Clark Run.....	500
Reed Run.....	500	Clinton Run.....	500
Reed Run, North Branch.....	500	Devens Creek.....	500
Ruse Hollow Creek.....	500	Dewight Creek.....	500
Stone Crusher Hollow Creek.....	500	Glance Creek.....	500
Swanson Run.....	500	Gordinier Run.....	500
Trout Run.....	500	Hammond Run.....	500
Drums, Lehigh River.....	800	Hartwick Run.....	500
Dudley, Miller Run.....	1,500	Janson Run.....	500
East Mahoney, Lakewood Lake.....	1,500	Kernan Run.....	500
Easton, Bushkill Creek.....	1,000	Knickerbocker Run.....	500
Ebensburg, Big Run.....	600	Lent Hollow Run.....	500
Cedar Run.....	600	Maundels Run.....	500
Chest Creek.....	600	Moores Run.....	500
Clear Creek.....	600	Pole Lick Run.....	500
Davis Creek.....	600	Post Creek.....	500
James Run.....	600	Rock Run.....	500
Jones Run.....	600	School House Run.....	500
Laurel Lick Run.....	600	Turner Creek.....	500
McBride Run.....	1,200	Veley Run.....	500
Moores Run.....	600	Whites Run.....	500
Morris Jones Creek.....	600	Whitney Creek.....	500
Nole Run.....	600	Henderson, Gulph Creek.....	1,200
Roaring Run.....	600	Howard, Laurel Run.....	1,000
Sheltig Run.....	600	Lucas Run.....	1,000
Skellys Run.....	600	Howellville, Valley Creek.....	1,200
Smith Run.....	600	Valley Creek, South Branch.....	1,200
Spruce Creek.....	600	Hughesville, Beaver Run.....	3,000
Tudor Run.....	600	Big Creek.....	3,000
Waters Run.....	600	Little Muncy Creek.....	3,000
Fairchance, Glendale Creek.....	1,000	Hulls, Sinnamahoning Creek, East	
Hayden Town Creek.....	1,000	Fork.....	1,500
Pine Run.....	1,000	Susquehanna River, East Fork.....	2,000
Fallentimber, Beaverdam Creek.....	1,800	Hyner, Hyner Run.....	2,000
Franklin, Lyons Run.....	600	Right Fork Creek.....	1,800
Patchel Run.....	1,000	Indiana, Fyock Run.....	1,200
Reed Run.....	1,000	Gillhours Run.....	1,200
Scott Run.....	1,000	Jersey Shore, Rauch Run.....	2,400
Two Mile Run.....	1,200	Johnstown, Alwine Run.....	1,000
Williams Run.....	1,000	Kane, Buck Run.....	1,000
Garden, Trout Creek.....	800	Fife Run.....	1,000
Valley Creek.....	1,200	Kinzua Creek, South Branch.....	1,000
Valley Creek, South Branch.....	1,200	Lanigan Run.....	1,000
Gillintown, Benner Run.....	1,000	Mill Creek.....	1,200
Black Moshannon Creek.....	2,000	Watermill Creek.....	1,200
Gorton Run.....	1,000	Kato, Beech Creek.....	6,000
Hicks Run.....	1,000	Panther Run.....	1,000
McKenney Run.....	1,000	Sandy Run.....	3,000
Myers Run.....	1,000	Wolfe Creek.....	1,000
Norton Run.....	1,000	King of Prussia, Gulph Creek.....	800
Pine Run.....	1,000	Trout Creek.....	800
Glen Iron, Bartley Run.....	500	Lakewood, Potato Creek, Head-	
Blue Run.....	500	waters.....	1,500
Branch Run.....	1,000	Lees, Valley Creek.....	1,200
Buffalo Creek.....	1,000	Valley Creek, South Branch.....	1,200
Furnace Gap Run.....	500	Lemont, Bear Meadow Gap Run.....	500
Laurel Run.....	1,000	Cedar Creek.....	1,000
Penns Creek.....	1,000	Centre Furnace Creek.....	500
Sheasley Run.....	1,000	Laurel Run.....	1,000
Spruce Run.....	500	Mountain Creek.....	1,000
Spitzer Run.....	500	Roaring Run.....	1,000
Stony Run.....	500	Ross Farm Pond.....	500
Glen Union, Baker Run.....	2,400	Shingletown Gap Creek.....	500
Bear Pan Run.....	600	Sinking Creek.....	1,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		Pennsylvania—Continued.	
Lemont, Slab Cabin Creek.....	1,000	Pen Argyl, Cherry Hollow Creek....	500
Spring Creek.....	1,000	Delabole Creek.....	1,000
Spruce Creek.....	1,000	Ross Valley Creek.....	1,000
Stone Creek.....	1,000	Zigles Creek.....	1,000
Lewisburg, Beaver Run.....	1,500	Philipsburg, Alder Run.....	2,000
Lewistown Junction, Alfarata Brook	600	Ardel Run.....	1,000
Fishers Meadow Brook.....	600	Bailey Run.....	1,000
McElhattan, Chatham Run.....	2,400	Barger Run.....	1,000
Lick Run.....	2,400	Barker Run.....	1,000
Mahaffey, Bear Run.....	600	Bark Shed Run.....	1,000
Curry Run.....	1,200	Beaver Run.....	1,000
Deer Run.....	600	Benner Run.....	1,000
Hazlett Run.....	600	Bigelow Run.....	1,000
Laurel Run.....	1,200	Big Spring Run.....	1,000
McCracken Run.....	600	Bilger Run.....	1,000
Miller Run.....	600	Black Bear Run.....	3,000
North Run.....	600	Black Moshannon Creek.....	5,000
Rogue Harbor Run.....	600	Butler Run.....	1,000
Saw Mill Run.....	1,200	California Run.....	1,000
Snyder Run.....	1,200	Carlin Run.....	1,000
Whiskey Run.....	1,200	Clover Run.....	1,000
Malins, Valley Creek.....	1,200	Cold Creek.....	4,000
Maple, Tout Creek.....	800	Cold Spring Run.....	1,000
Mauch Chunk, Bear Creek.....	1,000	Curry Run.....	1,000
James Run.....	500	Dayton Run.....	3,000
Mauch Chunk Creek.....	1,000	Deep Rock Run.....	3,000
Mud Run.....	1,500	Echo Run.....	1,000
Meadville, Gilbert's pond.....	600	Emigh Run.....	2,000
Mercersburg, Blue Spring Run.....	500	Flat Rock Run.....	1,000
Church Hill Run.....	500	Forge Run.....	1,000
Deckey Run.....	1,000	Four Mile Run.....	1,000
Milford, Dingmans Creek.....	†8,000	Forshey Run.....	1,000
Dwarfskill Creek.....	†8,000	Hess Run.....	1,000
Raymondskill Creek.....	†10,000	Hutton Run.....	1,000
Sawkill Creek.....	†5,000	Huzzard Run.....	1,000
Vandermark Creek.....	†5,000	Laurel Run.....	2,000
Mill Hall, Bull Run.....	300	Little Beaver Run.....	1,000
Cedar Run.....	300	Little Tom Run.....	1,000
Cedar Spring Run.....	300	Loop Run.....	1,000
Cherry Run.....	300	McCord Run.....	1,000
Comadiner Run.....	†2,000	Miller Run.....	1,000
Cooper Run.....	†2,000	Moravian Run.....	3,000
Duck Run.....	300	Morgan Run.....	1,000
Fishing Creek.....	{ †20,000	Nason Run.....	1,000
Fox Hollow Run.....	300	North Run.....	1,000
Hinley Run.....	300	One Mile Run.....	1,000
Little Fishing Creek.....	600	Patten Run.....	1,000
Long Run.....	†2,000	Pine Run.....	2,000
Lucas Run.....	†2,000	Rock Run.....	2,000
McElhattan Run.....	†3,000	Seneca Run.....	2,000
Matter Run.....	†2,000	Seven Spring Run.....	1,000
Muthler Run.....	300	Shields Run.....	2,000
Pepper Run.....	†2,000	Six Mile Run.....	6,000
Sand Spring Run.....	†2,000	Slate Run.....	2,000
Spring Run.....	†2,000	Sleepy Hollow Run.....	1,000
Spruce Run.....	†2,000	Smayes Run.....	1,000
Mill Lane, Valley Creek.....	1,200	Splash Run.....	1,000
Minersville, Big Creek.....	600	Spruce Run.....	1,000
Black Creek.....	600	Sterling Run.....	2,000
Deep Creek.....	600	Tomahawk Run.....	2,000
Indian Run.....	600	Tom Tit Run.....	1,000
West Creek.....	600	Trout Run.....	2,000
New Bloomfield, Juniata River, trib-		Turtle Spring Run.....	2,000
utary of.....	2,000	Twig Run.....	1,000
New Centerville, Tout Creek.....	800	Vail Run.....	1,000
Valley Creek.....	1,200	Walker Run.....	1,000
Newport, Big Spring Creek.....	1,200	White Stone Run.....	2,000
Osceola Mills, Bear Run.....	2,000	Winburne Run.....	1,000
Big Trout Run.....	2,000	Wolf Run.....	1,000
Coal Run.....	2,000	Pittsfield, Andrews Run.....	2,000
Gearhart Run.....	1,000	Barton Run.....	2,000
Minnow Run.....	1,000	Plane Brook, Valley Creek.....	1,200
Mountain Branch.....	2,000	Port Allegany, Comes Creek.....	1,000
Twin Root Run.....	2,000	Fair Run.....	1,000
Orwigsburg, Shoener Run.....	2,000	Hamilton Run.....	1,000
Paddy Mountain, Penns Creek.....	6,000	Rock Run.....	1,000
Paoli Road, Valley Creek.....	1,200	Skinner Creek, South Branch.....	1,000
Valley Creek, South Branch.....	1,200	Skinner Creek, West Branch.....	1,000
		Port Matilda, Bear Run.....	1,000
		Beaver Run.....	1,000

*Distribution of fish and eggs, fiscal year 1917—Continued*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		Pennsylvania—Continued.	
Port Matilda, Brown Run.....	1,000	Somerset, Lohr Run.....	400
Coon Hollow Run.....	1,000	North Fork Run.....	400
Flat Rock Creek.....	2,000	Shafer Run.....	400
Hawk Run.....	1,000	Weimer Run.....	400
McAllister Run.....	1,000	Stillwater, Fishing Creek.....	2,000
Meadow Creek.....	1,000	Stroudsburg, Little Bushkill Creek.....	1,200
Milligan Hollow Run.....	1,000	Summersville, Piney Creek, branch of	600
Pine Run.....	1,000	Tamaqua, Clear Spring Run.....	1,000
Sandy Run.....	1,000	Kestler Run.....	1,000
Sand Spring Run.....	1,000	Tobyhanna, Tobyhanna Creek.....	1,200
Shirer Run.....	1,000	Trout Run, Bear Run.....	12,000
Six Mile Run.....	2,000	Blacks Creek.....	12,000
Spring Run.....	1,000	Block House Creek.....	12,000
Spruce Run.....	1,000	Bunnell Run.....	12,000
Stony Creek.....	1,000	English Run.....	12,000
Tumbling Run.....	1,000	Flooks Run.....	12,000
Preston Park, Potato Creek.....	1,000	Four Mile Run.....	2,000
Ralston, Abbot Run.....	2,000	Little Pine Creek.....	12,000
Bear Run.....	2,000	Otter Run.....	2,000
Bear Trap Run.....	2,000	Pack Horse Creek.....	12,000
Bottle Run.....	2,000	Rock Run.....	12,000
Buck Run.....	2,000	Smith Run.....	12,000
Cold Run.....	2,000	Texas Creek.....	12,000
Elk Lick Run.....	2,000	Wolf Run.....	12,000
Frozen Run.....	2,000	Troy, Brace Creek.....	4,000
Hawks Run.....	2,000	Leonard Creek.....	3,000
Hellman Run.....	2,000	Ulysses, Newton Creek.....	500
Hounds Run.....	2,000	Uniontown, Glade Run.....	1,000
Long Run.....	2,000	Mill Run.....	1,000
Lycoming Creek.....	2,000	Quebec Run.....	1,000
Mill Creek.....	2,000	Valley Store, Valley Creek.....	1,200
Mill Run.....	2,000	West Chester, Mattock Run.....	1,000
Miners Run.....	2,000	Whiteland, Ashbridges Creek.....	1,000
Panther Run.....	2,000	Whiteland Creek.....	500
Pleasant Creek.....	2,000	Wilkes-Barre, Bowman Creek.....	2,500
Potash Run.....	2,000	Williamsport, Big Bear Creek.....	4,000
Red Run.....	2,000	Carter Run.....	3,000
Rock Run.....	2,000	Days Run.....	4,000
Salt Run.....	2,000	Hoagland Run, North Branch.....	3,000
Short Run.....	2,000	Laurel Valley Run.....	3,000
Wilhelm Run.....	2,000	Plunkett Creek.....	4,000
Wolf Run.....	2,000	Shingle Branch.....	3,000
Yellow Dog Run.....	2,000	Spooner Run.....	3,000
Renova, Baldwins Branch.....	600	Wolf Run.....	4,000
Bull Run.....	600	Windber, Beaver Run.....	600
Dark Hollow Creek.....	1,200	Beaverdam Creek.....	600
Green Lick Creek.....	1,200	Berkebile Run.....	600
Holly Branch.....	600	Berkey Run.....	600
Lebo Branch.....	600	Biscuit Spring Run.....	600
Lick Run.....	1,200	Bowser Spring Run.....	600
Lick Run, Left Fork.....	600	Clear Shade Creek.....	600
Little Green Lick Creek.....	600	Cub Run.....	1,200
Lorililly Creek.....	600	Dark Shade Creek.....	600
McCraney Run.....	600	Gloss Run.....	600
Oleona Creek.....	600	Laurel Run.....	600
Pump Station Creek.....	600	Layton Run.....	600
Seven Mile Run.....	600	Little Dark Shade Creek.....	600
Shingle Branch.....	1,200	Miller Run.....	600
Young Womans Creek, Left Fork.....	1,200	Moores Run.....	600
Young Womans Creek, Right Fork.....	1,200	Oldham Run.....	600
Young Womans Creek, Summer-son Fork.....	600	Otter Run.....	600
Richland, Krumstown Creek.....	500	Piney Run.....	600
Millards Lake.....	500	Roaring Fork Creek.....	1,800
Mill Creek.....	500	Sandy Run.....	600
Roaring Springs, Beaver Creek.....	1,800	Shade Creek.....	1,800
Three Spring Run.....	2,400	Shingle Run.....	600
Smithfield, Piney Creek.....	1,000	Wentz Run.....	600
Somerset, Ankney Run.....	400	Whitiker Run.....	600
Bare Rock Run.....	400		
Beam Run.....	400		
Brog Run.....	400		
Clear Run (A).....	400		
Clear Run (B).....	400		
Deeter Run.....	600		
Jones Mill Run.....	400		
Kooser Run.....	400		
Laurel Hill Creek.....	600		



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Rhode Island: Georgiaville, Harris's pond.....	42,000	South Dakota—Continued.	
South Carolina:		Rapid City, Dark Spring Lake.....	750
Walhalla, Bare Branch.....	1,000	Deer Creek.....	1,500
Colles Creek.....	1,500	Fair Ground Lake.....	1,500
Hamet Creek.....	1,000	Halley Lake.....	1,500
Mills Creek.....	1,000	Indian School Lake.....	2,250
Whitewater River.....	2,500	Jim Creek.....	1,500
South Dakota:		Keenan Pond.....	750
Buffalo Gap, Beaver Creek.....	1,500	Lime Creek.....	1,500
Deadwood, Two Bit Creek.....	4,000	Lime Kiln Creek.....	750
Dumont, Rapid Creek.....	750	Little Rapid Creek.....	3,750
Elmore, Ice Box Canyon Creek.....	2,000	Lockhart Pond.....	750
Raddick Gulch Creek.....	2,000	Long Pond.....	750
Spearfish Creek, Upper.....	4,000	Murphy Pond.....	750
Wild Cat Creek.....	2,000	Nugget Creek.....	1,500
Englewood, Bear Butte Creek.....	750	Power Lake.....	750
Bogus Jim Creek.....	750	Prairie Creek.....	1,500
Box Elder Creek.....	3,000	Round Pond.....	750
Corral Creek.....	750	Schamber Pond.....	750
East Fork, Spearfish Creek, Kill		Scott Pond.....	750
Daw Branch.....	1,500	Sickler Pond.....	750
Elk Creek.....	3,750	Slate Creek.....	2,250
Elk Creek, branch of.....	1,500	Spayde Pond.....	750
Elk Creek, Halls Branch.....	1,500	Spring Creek.....	2,250
Elk Creek, Hogan Branch.....	750	Superior Run.....	1,500
Elk Creek, West Branch.....	750	Tittle Spring Lake.....	1,500
Este Creek.....	2,250	Tunnell Creek.....	1,500
Hanna Creek.....	10,000	Victoria Creek.....	1,500
Hay Creek.....	6,000	Rochford, Gimlet Creek.....	1,500
Jim Creek.....	2,250	Little Rapid Creek.....	2,250
Keough Creek.....	5,000	Rapid Creek.....	2,250
Little Elk Creek.....	750	Silver Creek.....	750
Lower Elk Creek.....	3,000	Savoy, Beaver Creek.....	7,717
McCallis Creek.....	1,000	Little Spearfish Creek.....	25,717
Middle Box Elder Creek.....	10,750	Log Cabin Creek.....	10,000
Middle Elk Creek.....	2,250	South Dakota Fish Pond.....	5,000
North Box Elder Creek.....	750	Spearfish Creek.....	3,000
South Box Elder Creek.....	2,250	Spearfish, Beaver Creek.....	18,000
Spring Creek.....	4,750	Bill Cook Branch.....	4,000
Spruce Creek.....	1,750	Bridal Veil River.....	6,000
Ward Creek.....	6,000	Camp No. 2 Lakes.....	10,000
Upper Bear Butte Creek.....	1,500	Chicken Creek.....	8,000
Fairburn, Squaw Creek.....	1,500	City Creek.....	4,000
Hermosa, Battle Creek.....	3,000	Coxes Lake.....	15,000
Squaw Creek.....	750	Crago Branch.....	4,000
Hill City, Barthold Pond.....	750	Crow Creek.....	10,000
Dell Creek.....	1,500	Crow Creek, Authier Branch.....	5,000
Horse Creek.....	1,500	Dedrich Spring Branch.....	5,000
Spring Creek.....	5,250	Ernest Spring Branch.....	6,000
Spring Creek, Newtons Fork.....	3,000	Farmer Jones Creek.....	5,000
Upper Spring Creek.....	2,250	Hemlock Spring Branch.....	3,000
Hot Springs, Fall River.....	1,500	Henwood Branch.....	3,000
Upper Beaver Creek.....	1,500	Higgins Creek.....	15,000
Wind Cave Creek.....	4,500	Hilton Gulch Creek.....	10,000
Iron Creek, Iron Creek.....	9,216	Lake Branch.....	3,000
Martin, Bear-runs-in-the-lodge Creek.....	3,000	La Plant Branch.....	2,000
Little White River.....	3,000	Lindley Spring Branch.....	4,000
Nahant, Little Rapid Creek, West		Little Ranch Creek.....	8,000
Branch.....	1,500	Lower Redwater River.....	5,000
Rapid Creek.....	1,500	McCoffin Creek.....	8,000
Silver Creek.....	1,500	McGregors Branch.....	7,000
Spring Creek.....	750	McVey Spring Branch.....	3,000
Tilson Creek.....	1,500	Mill Branch.....	3,000
Piedmont, Little Elk Creek.....	1,500	Mardens Spring Branch.....	8,000
Pine Ridge, Wolf Creek.....	1,500	Mountain Meadow Creek.....	12,000
Wounded Knee Creek.....	3,000	Oak Spring Branch.....	3,000
Porcupine, Wounded Knee Creek.....	5,500	Owens Creek.....	3,000
Pringle, Beaver Creek.....	2,000	Park Spring Branch.....	3,000
Rapid City, Antlers Lake.....	1,500	Pettigrew Branch.....	3,000
Bogus Jim Creek.....	1,500	Power Dam Lake.....	2,000
Boland Creek Pond.....	750	Rapid Spring Branch.....	5,000
Box Elder Creek.....	1,500	River View Branch.....	4,000
Canyon Lake.....	750	Schmidt Branch.....	5,000
Castle Creek.....	1,500	Smith Spring Branch.....	5,000
City Spring Pond.....	750	Spearfish Creek.....	53,500
Cleghorn Spring Lake.....	750	Spring Brook.....	2,000
Cottonwood Lake.....	1,500	Spring Creek.....	13,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
<b>South Dakota—Continued.</b>		<b>Vermont—Continued.</b>	
Spearfish, Spring Draw Creek.....	10,000	Bolton, Beaver Meadow Brook.....	15,000
Stucco Mill Branch.....	4,000	Haney Hollow Brook.....	15,000
Toomey Branch.....	6,000	Jones Brook.....	17,000
Toomey Lake.....	8,000	Turk Brook.....	13,000
Town Creek Branch.....	2,000	Bradford, Maplewood Brook.....	13,000
Wears Branch.....	5,000	Braintree, Thresher Brook.....	13,000
Wildcat Creek.....	5,000	Brattleboro, Ames Hill Brook.....	1,000
Sturgis, Bear Butte Creek.....	7,500	Barber Brook.....	1,000
Deadman Creek.....	2,500	Bartlett Brook.....	11,000
Tilford, Morse Creek.....	1,500	Bingham Brook.....	1,000
Valentine, Rosebud Creek.....	1,500	Blanchard Brook.....	12,000
Schweigman Creek.....	1,000	Bonnyvale Brook.....	1,000
<b>Tennessee:</b>		Broad Brook.....	1,000
Bristol, Big Creek.....	1,000	Brown Brook.....	1,000
Elkmont, Jakes Creek.....	4,000	Bruce Brook.....	1,000
Little River.....	2,000	Bullock Brook.....	12,000
Erwin, Coffee Ridge Creek.....	2,000	Burdiet Brook.....	12,000
Spring Branch.....	750	Carl Sargent Brook.....	11,000
Garbers, Cherokee Creek.....	500	Chamberlain Brook.....	1,000
Ramsey Creek.....	500	Church Hollow Brook.....	1,000
Unicoi, Clear Fork Creek.....	250	Cold Brook.....	12,000
Wonderland Park, Laurel Creek.....	2,000	Crosier Brook.....	11,000
<b>Vermont:</b>		Dean Brook.....	1,000
Arlington, Battenkill River.....	51	Deer Park Brook.....	1,000
Beaver Brook.....	15,000	Dry Brook.....	12,000
Benedict Brook.....	52	Edson Akley Brook.....	1,000
Butternut Gutter Brook.....	12,000	Ellenwood Brook.....	12,000
Cole Brook.....	51	Flagg Brook.....	11,000
Deming Brook.....	52	Franklin Brook.....	11,000
Fayville Brook.....	51	Glidden Brook.....	1,000
Reed Brook.....	12,000	Goodenough Brook.....	11,500
Roaring Branch.....	51	Green River.....	1,000
Roaring Branch, South Fork.....	51	Halladay Brook.....	1,000
Warm Brook.....	51	Herrick Brook.....	11,000
Barnet, Aiken Brook.....	15,000	Higley Branch.....	1,000
East Peacham Brook.....	10,000	Hinesburg Brook.....	1,000
Harvey Brook.....	1,000	Houghton Brook.....	12,000
Roy Brook.....	1,000	Houghton Meadow Brook.....	1,000
Sucker Brook.....	18,000	Hunter Brook.....	1,000
Barre, Daune Wood Brook.....	11,000	Israel Wood Brook.....	12,000
La Fayette Brook.....	13,000	Jacobs Brook.....	12,000
Martin Brook.....	13,000	Jenks Brook.....	1,000
Towne Brook.....	13,000	Johnson Brook.....	1,000
Bennington, Barber Pond.....	300	King Charter Brook.....	12,000
Bickford Hollow Brook.....	300	Lynde Brook.....	1,000
Big Hell Hollow Brook.....	200	Marlboro Branch.....	1,000
Brown Brook.....	200	Meadow Brook.....	1,000
Bushnell Brook.....	200	Niles Brook.....	12,000
Chapel Brook.....	200	Reed Brook.....	1,000
Chase Brooks.....	200	Roaring Brook.....	1,000
Dewey Brook.....	200	Rock River.....	1,000
Dunville Brook.....	300	Rock River Branch.....	1,000
Evens Brook.....	22,000	Rock River, North Branch.....	1,000
Furnace Brook.....	300	Rudd Brook.....	14,000
Glastonbury Brook.....	300	Sam Sargent Brook.....	11,000
Ladd Brook.....	200	Slate Rock Pond.....	1,000
Little Hell Hollow Brook.....	14,000	Smith Brook.....	12,000
Perry Thompson Brook.....	15,000	South Newfane Brook.....	1,000
Rider Brook.....	200	Thayer Brook.....	12,000
Rockwood Brook.....	200	Tinker Brook.....	12,000
South Brook.....	300	Vick Warren Brook.....	12,000
Stratton Brook.....	13,000	Wait Brook.....	18,000
Sucker Pond.....	300	Ward Brook.....	12,500
Walloomsae River.....	300	West Dummerston Brook.....	1,000
Waters Brook.....	13,000	Williams Brook.....	11,000
Woodford Big Pond.....	300	Winchester Brook.....	11,000
Woodford City Brook.....	200	Wrisley Brook.....	1,000
		Bristol, Baldwin Brook.....	13,000
		Durfee Brook.....	11,000
		Hewitt Brook.....	11,000
		Norton Brook.....	12,000
		Paine Brook.....	11,000
		Cambridge, Ellsworth Brook.....	13,000
		Hutchins Brook.....	13,000
		McGuire Brook.....	15,000
		Macumber Brook.....	13,000
		Mansfield Brook.....	13,000
		Redmond Brook.....	14,000
		Reynolds River.....	14,000

## Distribution of fish and eggs, fiscal year 1917—Continued.

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Vermont—Continued.		Vermont—Continued.	
Cambridge, Waugh Brook.....	†3,000	Lyndonville, Dish Mill Brook.....	†10,000
Waugh Brook, East Branch.....	†3,000	Flowers Brook.....	†3,000
Canaan, Big Averill Brook.....	500	Keach Brook.....	†2,000
Big Averill Lake.....	1,000	Line Brook.....	†3,000
Black Branch (First).....	250	Lunenburg, Cat Bow Pond.....	†4,000
Black Branch (Second).....	500	McIndoe Falls, Chamberlain Brook.....	†3,000
Forest Lake.....	1,000	Creamery Brook.....	200
Roaring Brook.....	250	Manchester Brook.....	200
Yellow Branch.....	500	Moore Brook.....	400
Center, Larabee Brook.....	†3,000	Symmes Pond.....	†5,000
Chester, Chester Pond.....	†5,000	Manchester, Battenkill River.....	†8,000
Cuttingsville, Beaver Meadow Brook.....	†3,000	Cold Spring Brook.....	†3,000
Crocker Brook.....	†3,000	Lathrop Brook.....	†3,000
Danville, Hartshorn Brook.....	†2,000	Lye Brook.....	†4,000
Sucker Brook.....	†3,000	Morris Brook.....	†3,000
East Dorset, Battenkill River.....	†25,000	Manchester Depot, Battenkill River, West Branch.....	†5,000
Mad Tom Brook.....	†5,000	Marshfield, Beaver Pond.....	†5,000
Otter Creek.....	†3,000	Doctortown Brook.....	†5,000
East Hardwick, Bell Brook.....	†2,500	Ezra Mears Brook.....	†2,500
East Ryegate, Creamery Brook.....	†4,000	Lamberton Brook.....	†2,500
Moore Brook.....	†3,000	Niggerhead Brook.....	†2,500
Ely, Bannock Brook.....	1,500	Middlebury, Dutton Brook.....	†5,000
Enosburg Falls, Cold Hollow Brook.....	†3,500	Ingles Brook.....	†3,000
Ladd Trout Brook.....	†2,500	McDowell Brook.....	†3,000
Mineral Spring Brook.....	†2,500	Middlebury River.....	†8,000
Stoneville Brook.....	†2,500	Poor Farm Brook.....	†5,000
Tyler Brook, Bakersfield Branch.....	†4,000	Ripton River.....	†4,000
Greensboro Bend, East Greensboro Brook.....	†3,000	Ripton River, North Branch.....	†5,000
Lamoille River, Headwaters.....	†10,000	Steam Mill Brook.....	†3,000
Stannard Brook.....	†4,000	Middlesex, Long Brook.....	†5,000
Groton, Darling Pond.....	†50,000	Poorce Brook.....	1,000
Hardwick, Abutment Brook.....	†1,500	Montpelier, Lairds Pond.....	500
Bailey Brook.....	†2,500	Payne Brook.....	†3,000
Collier Brook.....	†2,500	Morrisville, Billings Brook.....	†6,000
Cooper Brook.....	†3,000	Bugbee Brook.....	†1,500
Currier Brook.....	†1,500	Cooper Brook.....	†2,000
Eaton Brook.....	†2,500	Darling Brook.....	†2,000
High Trestle Brook.....	†3,000	Green River.....	†4,500
Laundry Brook.....	†2,500	Hazen Brook.....	†2,000
Norris Brook.....	†1,500	McNall Brook.....	†4,000
Paine Brook.....	†3,500	Potash Brook.....	†2,500
Porter Brook.....	†6,000	Ryder Brook.....	†4,500
Holden, Barnard Brook.....	†5,000	Smith Brook.....	†2,000
Bassett Brook.....	†3,000	Upper Terrill Brook.....	†4,000
Billings Brook.....	200	Newfane, Grassy Brook.....	1,000
Clovervale Brook.....	†6,000	New Haven Junction, Dike Brook.....	†3,000
Clovervale Brook, East Branch.....	†4,000	Hubbard Brook.....	†3,000
Coal Kiln Brook.....	†5,000	Newport, Buck Brook (A).....	†2,500
Coburn Brook.....	†5,000	Buck Brook (B).....	†3,500
East Brook.....	400	Center Brook.....	†3,500
Elliott Brook.....	†5,000	Day Brook.....	†3,500
Furnace Brook.....	†20,000	Hatton Brook.....	†2,500
Furnace Brook, North Branch.....	†15,000	Holland Pond.....	†1,000
Furnace River, West Branch.....	†10,000	Jud Brook.....	†4,000
Hewitt Brook.....	200	Kidder Pond.....	†1,000
Little Brook.....	200	Long Brook.....	†7,000
Osgood Brook.....	200	Orcutt Brook.....	†4,000
Picnic Brook.....	200	Papenaw Brook.....	†2,500
Randall Brook.....	†5,000	Tice Brook.....	†5,000
Ripley Brook.....	200	Turtle Pond.....	†6,000
Valley View Farm Brook.....	†6,000	Vailes Pond.....	†1,000
Wardwell Brook.....	200	Ware Brook.....	†4,000
Hyde Park, Tyndal Pond.....	†7,500	Watson Brook.....	†4,000
Lake, Averill Brook.....	†4,000	North Troy, Jay Branch.....	†5,000
Big Averill Lake.....	†4,000	Norton Mills, Nulhegan River, Black Branch.....	†12,500
Black Branch.....	†4,000	Nulhegan River, East Branch.....	†14,500
Coaticook River.....	†6,000	Number Six Brook.....	†5,000
Cole Brook.....	†2,500	Roaring Brook.....	†2,000
Forest Brook.....	†4,000	Swanson Brook.....	†4,000
Little Averill Brook.....	†2,000	Yellow Branch.....	†6,000
Little Averill Lake.....	†3,000	Norwich, Lake Mitchell.....	†105,000
Morrill Brook.....	†6,000	Orleans, Dewey Brook.....	7,300
Norton Lake.....	†5,500	Gallup Brook.....	†3,000
Nulhegan River.....	†15,000	Partin Brook.....	†3,000
Lyndon, Hawkins Brook.....	†5,000	Wyman Brook.....	†3,000
Sheldon Brook.....	†3,000		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Vermont—Continued.		Vermont—Continued.	
Pittsford, Chittenden Pond.....	†15,000	St. Johnsbury, Walter Andrie Brook.....	7,000
Plainfield, Bancroft Pond.....	†3,000	Wright Brook.....	2,000
Kingsbury Branch.....	†3,000	Shaftsbury, Warm Brook.....	†5,000
Pigeon Pond.....	†3,000		80
Slayton Brook.....	†3,000	Warm Brook, tributaries of.....	†2,000
Poultney, Endless Brook.....	†5,000		80
Hicks Brook.....	†3,000	South Londonderry, Farnum Brook.....	†7,000
Lewis Brook.....	†5,000	High Bridge Brook.....	†3,000
Morse Hollow Brook.....	†4,000	Livermore Brook.....	†7,000
Poultney River.....	†15,000	Mud Pond Brook.....	†5,000
Riley Brook.....	†5,000	Tannery Brook.....	†6,000
Proctorsville, Williams River.....	†9,000	Winhall Hollow Brook.....	†5,000
	500	South Ryegate, Bailey Pond.....	†5,000
Randolph, Adams Brook.....	†4,000	Long Pond.....	†5,000
Alco Pond.....	†5,000	Scott Brook.....	†15,000
Annis Brook.....	†3,000	South Wallingford, Otter Creek.....	†10,000
Ayers Brook.....	†5,000	Stowe, Gold Brook.....	†4,000
Bass Brook.....	†2,000	West Branch River.....	†8,000
Bear Hill Brook.....	†3,000	West Hill Brook.....	†3,000
Beedle's pond.....	†2,000	Sunderland, Battenkill River.....	150
Blanchard Brook.....	†2,500		150
Bowman Brook.....	†3,000	Lathrop Brook.....	†2,000
Chandler Brook.....	†4,000	Sutton, Bailey Brook.....	†3,000
Clough Brook.....	†4,000	Bundy Brook.....	†1,000
Cushman Brook.....	†3,000	Burnham Brook.....	†2,000
Fishers Brook.....	†2,000	Butterfield Brook.....	†1,500
Guild Brook.....	†2,500	King Brook.....	†1,500
Gulf Brook.....	†3,000	Reed Brook.....	†1,500
Holman Brook.....	†3,000	Richards Brook.....	†1,500
Howard Hill Brook.....	†3,500	Sanborn Brook.....	†2,000
Mann Brook.....	†2,000	Twombly Brook.....	†1,500
Meadow Brook.....	†3,500	Willard Brook.....	†2,000
Morse Brook.....	†1,500	Taftsville, Skunk Hollow Brook.....	300
Mud Pond.....	†1,000	Townshend, Eddy Brook.....	†4,000
Poverty Lane Brook.....	†3,000	Jay Brook.....	†4,000
Roaring Brook (A).....	†2,000	Mill Brook.....	1,000
Roaring Brook (B).....	†3,000	Peaked Mountain Brook.....	†4,000
Roods Brook.....	†1,500	Plumb Brook.....	†3,000
Soper Brook.....	†2,000	Wallingford, Otter Creek.....	†10,000
Spears Brook.....	†3,000	Waterbury, Hill Brook.....	†6,000
Thayer Brook.....	†3,000	Liscom Guild Brook.....	†2,000
Upper Ayers Brook.....	†2,500	Little River.....	†5,000
Readsboro, Bailey Brook.....	600	Ricker Mountain Brook.....	†5,000
Canedy Brook.....	600	Shaw Brook.....	†3,000
Estey Brook.....	600	Stevens Brook.....	†4,000
Olden Brook.....	600	Swassey Brook.....	†4,000
West Branch.....	1,800	Thatcher Brook.....	†10,000
Rutland, Brewer Brook.....	†5,000	Watts Brook.....	†5,000
Britton Brook.....	†13,000	Wheeler Brook.....	†2,500
Castleton River.....	†8,000	West Burke, Bugbee Brook.....	†4,000
Cold River.....	†6,000	Cheney Brook.....	†2,500
Connors Brook.....	†3,000	Clark Brook.....	†10,000
Dawson Brook.....	†2,000	Eaden Brook.....	†10,000
Dunklee Brook.....	†5,000	Jobs Pond Brook.....	†6,000
Glynn Brook.....	†4,000		200
Jim Blake Brook.....	†3,000	Legacy Brook.....	†2,000
McDevitt Brook.....	†3,000		180
Moon Brook.....	†3,000	Moulton Brook.....	†6,500
O'Brien Brook.....	†2,000		200
Paint Mine Brook.....	†3,000	Page Brook.....	†3,000
Parker Brook.....	†3,000		200
Phillips Brook.....	†2,000	School House Brook.....	†2,000
School House Brook.....	†3,000		180
Scott Brook.....	†4,000	Townsend Brook.....	†3,000
Shrewsbury Pond.....	†2,000		200
Spring Brook.....	†3,000	West Dummerston, Baker Brook.....	†6,000
Stewart Brook.....	†3,000	Black Mountain Brook.....	†3,000
Sugar Hollow Brook.....	†10,000	Clay Pit Brook.....	†3,000
Tenney Brook.....	†4,000	Walker Brook.....	†3,000
St. Albans, Miner Brook.....	†4,000	West Hartford, Dana Brook.....	1,500
St. Johnsbury, Blodgett Brook.....	1,000	Fales Pond.....	†5,000
Chesterfield Brook.....	4,000	Sunny Brook.....	200
Hastings Brook.....	3,000	West Pawlet, Indian River.....	†10,000
Hawkins Brook.....	6,500		300
Lawrence Pond (A).....	2,000	Windhall, Jamaica Pond.....	1,000
Lawrence Pond (B).....	1,500	Woodstock, Beaver Meadow Brook.....	†2,000
Meadow Brook.....	200	English Mills Brook.....	†5,000
Sleepers River.....	†70,709	Fullerton Brook.....	†2,000
Spaulding Brook.....	3,000	Gallup Brook.....	†3,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Vermont—Continued.</b>		<b>West Virginia—Continued.</b>	
Woodstock, Gulf Brook.....	15,000	Alexander, Lower Dry Run.....	180
Hedgehog Brook.....	11,500	Margans Camp Run.....	180
Kedron Brook.....	18,000	Phillips Camp Run.....	180
Lakota Lake.....	500	Trout Run.....	180
Morgan Brook.....	11,500	Upper Dry Run.....	180
North Bridgewater Brook.....	14,000	Beard, Locust Creek.....	800
Ottawaquehee River.....	17,000	Dobbin, Stony River Lake.....	2,000
Prosper Brook.....	17,000	Gladly, Cheat River, Gladly Fork.....	4,400
Richardson Brook.....	12,000	Hendricks, Otter Creek.....	1,600
Smith Brook.....	13,000	Keyser, Cranes Nest Run.....	1,550
South Pomfret Brook.....	15,000	Eliber Spring Run.....	625
White Brook.....	13,000	Jordan Run.....	800
<b>Virginia:</b>		Mill Run.....	500
Arcadia, Jennings Creek.....	2,000	Whips Gap Run.....	800
Jennings Creek, North Fork.....	2,000	Kingwood, Ashpole Run.....	270
Middle Creek.....	2,000	Buffalo Run.....	270
North Creek.....	2,000	Littleton, Wolf Run.....	450
Sprouts Run.....	2,000	Manown, Morgans Run.....	800
Atkins, Nicks Run.....	3,400	Newlon, Buckhannon River, West Fork.....	3,200
Bedford, Otter River, Stony Fork.....	2,000	Piedmont, Thompson Run.....	250
Big Island, Hunting Creek.....	8,000	Raleigh, Fat Creek.....	800
Buena Vista, Enchanted Creek.....	2,000	Spangler, Hannah Run.....	450
Irish Creek.....	2,000	Terra Alta, Joes Run.....	900
Pryors Cove Creek.....	2,000	Salt Lick Creek.....	800
Damascus, Park Branch.....	3,000	Wildell, Greenbrier River, West Prong.....	4,000
Edinburg, Laurel Run.....	1,600	Wilsonia, Silcot Run.....	1,200
Little Stony Creek.....	1,600	Winterburn, Greenbrier River.....	630
Elkton, Boones Run.....	2,400	<b>Wisconsin:</b>	
Swift Run.....	3,000	Abbotsford, Eau Plain River.....	1,200
Hardwood, Hayes Creek.....	1,000	Adams, Duck Creek.....	668
Harrisonburg, Dry River.....	2,500	Jackson Creek.....	800
Hunter, Calvin Run.....	2,000	Schoonover Creek.....	334
Little Difficult Run.....	1,600	Alma, Bohris Valley Creek.....	1,200
Laurel Fork, Big Reed Island Creek.....	2,000	Breams Valley Creek.....	1,200
Mud Fork Creek.....	1,000	Cooke Valley Creek.....	2,500
Stone Mountain Creek.....	2,000	Friede Valley Creek.....	1,200
Lexington, South Buffalo Creek.....	2,000	Johns Valley Creek.....	1,200
McGaheysville, Stony Run.....	1,500	Little Waumandee Creek.....	1,200
Natural Bridge, Back Run.....	2,000	Norwegian Valley Creek.....	2,500
Elk Creek.....	3,000	Schaufs Valley Creek.....	1,200
Olinger, Thompson Creek.....	1,500	Trout Valley Creek.....	2,500
Riverside, Whites Run.....	2,000	Waumandee Creek.....	2,500
Shenandoah, Pitt Spring Run.....	2,400	Arcadia, Big Beaver Creek.....	2,000
Staunton, Crab Run.....	2,400	Bruce Creek.....	2,000
Strasburg, Waites Run.....	2,400	Elm Creek.....	2,000
Tazewell, Clear Fork Creek.....	2,000	Knutson Creek.....	1,000
Little Creek.....	2,000	Little Beaver Creek.....	1,000
Plum Creek.....	2,000	Newcomb Creek.....	2,000
Roaring Fork Creek.....	2,000	North Creek.....	2,000
Troutdale, Fox Creek.....	2,000	Stony Brook.....	2,000
Laurel Creek.....	3,000	Vrall Creek.....	1,000
Waterlick, Dilbeck Run.....	1,600	Ashland, Cedar Creek.....	2,000
Woodstock, Paddy Run.....	1,600	Fish Creek.....	8,000
Peters Mill Run.....	1,600	Pine Creek.....	5,000
<b>Washington:</b>		Whittelsey Creek.....	3,000
Clarkston, Alpowa Creek.....	750	Athens, Rib River.....	1,600
Du Pont, Lyons Lake.....	5,000	Bangor, Adams Valley Creek.....	1,200
Everett, Applicant.....	*100,000	Big Creek.....	800
Republic, Sanpoil River.....	600	Burns Creek.....	800
Springdale, Swamp Creek.....	450	Dutch Creek.....	1,200
Stevenson, Ena Lake.....	900	East Branch.....	800
Equan-not Lake.....	900	Eynon Creek.....	800
Patsuk Lake.....	450	Fish Creek.....	800
Shelipo Lake.....	675	Kolkman's Creek.....	800
Tohomish Lake.....	675	Little Fish Creek.....	800
Tacoma, Waldes Rhue Lake.....	5,000	Mosher Creek.....	400
Vancouver, Cedar Creek.....	15,000	Sand Creek.....	1,200
Salmon Creek.....	20,000	Whites Creek.....	800
Whipple Creek.....	10,000	Barneveld, Johnson Creek.....	400
<b>West Virginia:</b>		Black River Falls, Allen Creek.....	400
Albright, Cheat River.....	270	Arnold Creek.....	400
Elgies Run.....	1,600	Bacon Creek.....	400
Muddy Creek.....	720	Clear Creek.....	400
Roaring Creek.....	900	Dicky Creek.....	400
Alexander, Beech Run.....	270	French Creek.....	400
Birch Fork Creek.....	540	Hoffman Creek.....	400
Flint Run.....	180		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Black River Falls, Kenyon Creek ..	400	Durand, Arkansas Creek .....	500
Levis Creek .....	400	Arkansas Creek, Middle Branch ..	500
Morrison Creek .....	400	Averill Creek .....	500
Perry Creek .....	400	Big Arkansas Creek .....	500
Pine Creek .....	400	Cooley Creek .....	500
Ranch Creek .....	400	Duchane Creek .....	1,000
Roaring Creek .....	400	Fall Creek .....	500
Robinson Creek .....	400	Herron Creek .....	1,000
Silver Creek .....	400	Joe Gray Creek .....	500
Slosser Creek .....	400	Little Arkansas Creek .....	500
Snow Creek .....	400	Little Missouri Creek .....	1,500
Squaw Creek .....	400	Little Plum Creek .....	500
Staunton Creek .....	400	Manion Creek .....	500
Tank Creek .....	400	Orlady Creek .....	500
Town Creek .....	400	Pattison Creek .....	1,000
Trout Creek .....	400	Ryder Creek .....	500
Van Herset Creek .....	400	Schue Creek .....	1,000
Visno Creek .....	400	Spring Creek .....	1,000
Blair, Beaver Creek, North Branch ..	3,000	Eau Claire, Andrews Creek .....	800
Beaver Creek, South Branch .....	3,000	Annie Creek .....	800
Bloomer, McCanns Creek .....	3,200	Bessie Creek .....	400
Sand Creek .....	800	Brown Creek .....	400
Blue Mounds, Austin Creek .....	400	Clark Creek .....	400
Boley Creek .....	400	Culver Creek .....	800
Frame Creek .....	400	Dale Creek .....	400
Froli Creek .....	400	Evans Creek .....	800
McKinley Creek .....	400	Mildred Creek .....	800
Ruste Creek .....	400	Palmer Creek .....	800
Shea Creek .....	400	Sandy Creek .....	400
Topper Creek .....	400	Willow Creek .....	400
Bowler, Henning Creek .....	800	Edgerton, Anthony Spring Creek ..	334
Straussberg Creek .....	800	Badfish Creek .....	500
Brokaw, Silver Creek .....	2,000	Caledonia Spring Creek .....	167
Casco, Casco Creek .....	1,600	Greens Creek .....	167
Zickmund Run .....	800	Lynn Creek .....	335
Cashon, Ames Creek .....	600	Silver Creek .....	335
Hagen Creek .....	600	Eland, Eland Creek .....	1,600
Norbo Creek .....	600	Embarras River .....	800
Schriener Creek .....	600	Embarras River, branch of .....	400
Shannon Creek .....	600	Embarras River, Middle Branch ..	1,200
Cayuga, Bittner Creek .....	400	Eleva, Adams Creek .....	400
Cayuga Creek .....	400	Bennet Valley Creek .....	400
Earnest Creek .....	800	Big Creek (A) .....	400
Eight Mile Creek .....	400	Big Creek (B) .....	400
Iron River .....	800	Bolinger Creek .....	400
Lighter Creek .....	400	Chimney Rock Creek .....	400
Mill Creek .....	400	Fifteen Mile Creek .....	400
Mud Creek .....	400	Haaken Creek .....	400
Ore Creek .....	800	John Hoven Creek .....	400
Spring Creek .....	400	Lindsey Creek .....	400
Cylon, Hay Creek .....	400	McCurran Creek .....	400
Hutton Creek .....	800	Rosman Creek .....	400
Spring Brook .....	800	Sunum Creek .....	400
Willow River, South Fork .....	1,600	Tolefsen Creek .....	400
Danbury, Bangs Creek .....	1,500	Trout Creek .....	400
Darlington, Lovetts Branch .....	400	Elkhart Lake, Crystal Lake .....	800
Otter Creek .....	500	Mullet River .....	800
Deer Park, Willow River, South Fork ..	800	Mullet River, branch of .....	1,200
Delta, Spring Lake .....	5,000	Elkhorn, Spring Prairie Creek .....	1,134
Dodgeville, Blotz Creek .....	400	Fontana Spring Brook .....	334
Conley Creek .....	400	Whitewater Spring Creek .....	334
Cox Hollow Creek .....	400	Williams Bay Spring Creek .....	400
Flint Creek .....	400	Elk Mound, Mud Creek .....	3,200
Hendy Creek .....	400	Ellis Junction, Smith Creek .....	400
Jones Creek .....	400	Thunder River .....	1,200
Murphy Creek .....	400	Elmwood, Big Mosourie Creek .....	1,200
Rock Creek .....	334	Brush Creek .....	400
Wedlake Run .....	400	Cave Creek .....	800
Williams Creek .....	400	Mosourie Creek, South Fork .....	800
Willow Creek .....	400	Plum Creek, South Fork .....	1,200
Yager Creek .....	400	Fairchild, Graves Mill Creek .....	400
Donaldson, Muskrat Creek .....	668	Hanson Creek .....	400
Spring Creek .....	1,200	McLaren Creek .....	400
Swamp Creek .....	1,600	Marten Creek .....	400
Tamarack Creek .....	1,200	Mill Creek .....	400
Dunbar, Pike River, South Branch ..	1,600	Newman Creek .....	400
		Searls Creek .....	400

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Fairchild, Snake Creek.....	400	Independence, Russell Valley Creek.....	1,000
Tolles Creek.....	400	Ruste Creek.....	1,000
Travis Creek.....	400	Schaffner Creek.....	1,000
Fond du Lac, Camp Ground Creek.....	1,301	Simonsen Valley Creek.....	1,000
Gans Creek.....	501	Skogstad Creek.....	1,000
Gillett Creek.....	400	Slanten Valley Creek.....	1,000
Hobbs Creek.....	400	Solfest Creek.....	1,000
Keys Creek.....	400	Traverse Valley Creek.....	1,000
Mulvey Creek.....	800	Ulberg Creek.....	1,000
Parsons Creek.....	1,301	Ute Creek.....	1,000
Phelps Creek.....	334	Van Tassel Creek.....	1,000
Rucks Creek.....	800	Veum Creek.....	1,000
Sheridan Creek.....	400	Walls Creek.....	1,000
Strook Creek.....	400	Warner Creek.....	1,000
Fountain City, American Creek.....	2,600	Zimmers Valley Creek.....	1,000
Cream Valley Creek.....	1,300	Iowa Falls, Elk Run Creek.....	2,000
Eagle Valley Creek.....	1,200	Kellogg, Snake Creek.....	3,600
Glencoe Creek.....	1,300	Kilbourn, Corning Creek.....	400
Johns Valley Creek.....	1,300	Gilmore Creek.....	400
Pipers Valley Creek.....	1,200	Gulch Creek.....	400
Foxboro, Empire Creek.....	1,500	Plainville Creek.....	1,200
Galesville, Beaver Creek, North Branch.....	1,800	La Crosse, Dutch Creek.....	1,600
Beaver Creek, South Branch.....	1,800	Eagle Creek.....	2,000
Dutch Creek.....	600	Halfway Creek.....	3,200
Franches Creek.....	1,200	Sand Lake Cooley Creek.....	2,400
Silver Creek.....	600	Spring Cooley Creek.....	1,600
Tamarac Creek.....	1,800	State Road Cooley Creek.....	1,600
Glen Flora, Bear Creek.....	400	La Farge, Bear Creek.....	800
Deer Tail Creek.....	800	Manitowoc, Black Creek.....	1,200
Josie Creek.....	400	Branch River.....	1,200
Little Jump River.....	400	Cootway Creek.....	400
Main Creek, Middle Fork.....	800	Fisher Creek.....	400
Main Creek, South Fork.....	800	Francis Creek.....	400
Silver Creek.....	400	Kappelman Creek.....	800
Skinner Creek, North Fork.....	400	Kromfort Creek.....	400
Skinner Creek, South Fork.....	800	Point River.....	400
Gordon, Ox Creek.....	†5,000	Marengo, Bruinsweiler Creek.....	†7,000
Grand Rapids, Chester Creek.....	1,600	Cody Creek.....	†3,000
Harvey Creek.....	800	Forsythe Creek.....	†2,000
Seven Mile Creek.....	800	Marengo River.....	†5,000
Hancock, Little Roche a Cri Creek.....	1,200	Spring Creek.....	†4,000
Hatley, Plover River.....	2,672	Mauston, Big Creek.....	800
Hortonville, Black Otter Creek.....	800	Brewer Creek.....	800
Independence, Amundson Creek.....	500	Mill Creek.....	800
Bennett Creek.....	1,000	Smith Creek.....	400
Bjerkland Creek.....	500	Mellen, Beaver Creek.....	†3,000
Borst Valley Creek.....	1,000	Brown Creek.....	†4,000
Burnt Valley Creek.....	1,000	Camp 20 Creek.....	†3,000
Chimney Rock Creek.....	1,000	Cleveland Creek.....	†4,000
Cooks Creek.....	1,000	Dellean Creek.....	†5,000
Davis Creek.....	1,000	Erle Creek.....	†7,000
Davis Valley Creek.....	1,000	Fox Creek.....	†4,000
Dubiel Creek.....	1,000	Gravelly Creek.....	†4,000
Engum Valley Creek.....	1,000	Happy Creek.....	†4,000
Faar Creek.....	1,000	Hard Scrabble Creek.....	†4,000
Fernright Creek.....	1,000	Kings Creek.....	†5,000
Filla Creek.....	1,000	McCarty Creek.....	†6,000
Grietz Creek.....	1,000	Mellen Creek.....	†3,000
Grunem Creek.....	1,000	Mink Creek.....	†4,000
Gunderson Valley Creek.....	1,000	Minnow Creek.....	†4,000
Hawkenson Creek.....	1,000	Mirror Creek.....	†5,000
Holman Creek.....	1,000	Rocky Run.....	†3,000
Hulberg Creek.....	1,000	Scott and Taylor Creek.....	†5,000
Hunts Valley Creek.....	1,000	Seipel Creek.....	†4,000
Husselgard Creek.....	1,000	Silver Creek.....	†4,000
Johnson Creek.....	1,000	Slow Shadow Creek.....	†5,000
Killness Creek.....	1,000	Stony Creek.....	†4,000
Kurth Creek.....	1,000	Trout Creek.....	†4,000
Lewis Creek.....	1,000	Willow Creek.....	†4,000
Lindon Creek.....	1,000	Menomonie, Adams Creek.....	1,103
Lygas Creek.....	1,000	Anderson Creek.....	1,103
Maloney Creek.....	1,000	Annis Creek.....	1,103
Nelson Valley Creek.....	1,000	Asylum Creek.....	1,103
North Branch.....	1,000	Big Beaver Creek.....	1,103
Plum Creek.....	1,000	Big Elk Creek.....	1,103
Popes Creek.....	1,000	Big Hay Creek.....	1,103
Roskos Creek.....	1,000	Big Meadow Creek.....	1,103
		Big Missouri Creek.....	1,103

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Menomonie, Big Otter Creek.....	1, 103	Menomonie, Wolf Creek.....	1, 103
Biss Creek.....	1, 103	Merrill, McCloud Creek.....	800
Blair Creek.....	1, 103	Newwood Creek.....	800
Bolin Creek.....	1, 103	Pine Creek.....	800
Bubbling Spring Creek.....	1, 103	Six Mile Creek.....	800
Cady Creek.....	1, 103	Millston, Ketchum Creek.....	800
Campbell Creek.....	1, 103	Lambert Creek.....	800
Clack Creek.....	1, 103	Pigeon Creek.....	800
Connor Creek.....	1, 103	Robinson Creek.....	800
Coon Creek.....	1, 103	Rudd Creek.....	800
Cranberry Creek.....	1, 103	Mondovi, Armor Valley Creek.....	400
Crosby Creek.....	1, 103	Bennett Valley Creek.....	400
Dahl Creek.....	1, 103	Carroll Creek.....	400
Drowley Creek.....	1, 103	Day Creek.....	400
Dushane Creek.....	1, 103	Dillion Creek.....	400
Eau Galle River.....	1, 103	Dover Creek.....	400
Eddy Creek.....	1, 103	Dutch Creek.....	400
Eighteen Mile Creek.....	1, 103	Fifteen Creek.....	400
Enemies Creek.....	1, 103	Ford Creek.....	400
Galloway Creek.....	1, 103	Harvey Creek.....	400
Gilbert Creek.....	1, 103	Hayes Creek.....	400
Hall Creek.....	1, 103	Merril Creek.....	400
Hay Creek.....	1, 103	Modera Creek.....	400
Hay River, North Fork.....	1, 103	Rock Creek.....	400
Hay River, South Fork.....	1, 103	Rosman Creek.....	400
Hobbs Creek.....	1, 103	Whelan Creek.....	400
Honey Creek.....	1, 103	White Creek.....	400
Iron Creek.....	1, 103	Monticello, Blum Creek.....	335
Irving Creek.....	1, 103	Carroll Creek.....	500
Jesse Creek.....	1, 103	Loertscher Creek.....	334
Johns Creek.....	1, 103	Marty Creek.....	335
Johnson Creek.....	1, 103	New Lisbon, Fountain Creek.....	800
King Creek.....	1, 103	Macomber Creek.....	1, 200
Knight Creek.....	1, 103	Mead Creek.....	1, 200
Lamb Creek.....	1, 103	Northcott Creek.....	800
Lindsay Creek.....	1, 103	Webster Creek.....	800
Little Beaver Creek.....	1, 103	Newry, Homstad Creek.....	600
Little Elk Creek.....	1, 103	Norwalk, Brunner Creek.....	334
Little Missouri Creek.....	1, 103	Fairbanks Creek.....	1, 200
Little Otter Creek.....	1, 103	Matis Creek.....	1, 200
Little Sand Creek.....	1, 103	Richards Creek.....	1, 200
Losby Run.....	1, 103	Rockaman Creek.....	600
Lower Pine Creek.....	1, 103	Schells Creek.....	600
Lynch Creek.....	1, 103	Schlutman Creek.....	600
McArthy Creek.....	1, 103	Slickman Creek.....	600
Miller Creek.....	571	Spring Creek.....	600
Mores Creek.....	1, 103	Spring Valley Creek.....	1, 200
Mud Creek.....	1, 103	Summit Creek.....	334
Mud Creek, East Fork.....	1, 103	Traschel Creek.....	334
Mud Creek, North Fork.....	1, 103	Oakfield, Camp Ground Creek.....	800
Owen Creek.....	1, 103	Willow Creek.....	800
Palmer Creek.....	571	Otis, Averill Creek.....	800
Parker Creek.....	1, 103	Hanson Creek.....	800
Popple Creek.....	1, 103	Johnson Creek.....	800
Proper Creek.....	1, 103	Johnson Creek, East Branch.....	800
Quarder Creek.....	1, 103	Pat Smith Creek.....	800
Quilling Creek.....	1, 103	Pine Creek.....	800
Rock Creek.....	1, 103	Pine Creek, North Branch.....	400
Rush Creek.....	1, 103	Prairie River.....	2, 000
Sand Creek.....	1, 103	Willow Creek.....	800
Shafer Creek.....	1, 103	Park Falls, Rapid Creek.....	1, 200
Simonson Creek.....	1, 103	Rock Creek.....	800
Smith Creek.....	1, 103	Sand Creek.....	400
Spring Creek.....	1, 103	Patzau, Empire Creek.....	7, 500
Stoner Creek.....	1, 103	Pembino, Boulder Creek.....	400
Styer Creek.....	1, 103	Mullony Creek.....	400
Thum Creek.....	1, 103	Pemene Creek.....	400
Tiffany Creek.....	1, 103	Silver Creek.....	734
Torgerson Creek.....	1, 103	Smith Creek.....	400
Trout Creek.....	1, 103	Trestle Creek.....	400
Upper Pine Creek.....	1, 103	Pepin, Big Plum Creek.....	1, 300
Valley View Creek.....	1, 103	Bogus Creek.....	650
Vance Creek.....	1, 103	Little Plum Creek.....	650
Varney Creek.....	1, 103	Lost Creek.....	650
Washburn Creek.....	1, 103	Porcupine Creek.....	650
Watterson Creek.....	1, 103	Roaring River.....	1, 300
Wilson Creek.....	1, 103	Pewaukee, Spring Creek.....	500
Wilson Creek, North Branch.....	1, 103	Phelps, Twin Creek.....	334



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Plainfield, North Creek.....	1,600	Tomahawk, Armstrong Creek.....	400
Roche a Cri Creek.....	2,000	Bearskin River.....	800
Ten Mile Creek.....	800	Berry Creek.....	400
Readstown, Albert Johnson Creek..	400	Big Pine Creek.....	400
Black Bottom Creek.....	400	Hay Creek.....	400
Boyle Creek.....	400	Keuhling Creek.....	400
Clancy Creek.....	400	Little Pine Creek.....	800
Day Creek.....	400	Pickeral Creek.....	400
Flanagan Creek.....	400	Richie Creek.....	800
Fortney Creek.....	400	Spring Creek.....	400
Govier Creek.....	400	Squaw Creek.....	400
Halls Creek.....	400	Trout Creek.....	800
Hanson Creek.....	400	Trempealeau, American Valley Creek..	1,200
Harrison Hollow Run.....	400	Beaver Creek.....	3,800
Herrid Creek.....	400	Beaver Creek, North Branch.....	1,400
Jacobson Branch.....	400	Church Valley Creek.....	1,200
Johnson Creek.....	400	Corrigans Creek.....	1,400
Midthun Creek.....	400	Corrigans Valley Creek.....	1,200
Morse Creek.....	400	Crystal Creek.....	1,400
Munson Creek.....	400	Dutch Creek.....	3,800
Norwegian Hollow Run.....	400	Ettrick Valley Creek.....	2,400
Plum Creek.....	400	Fox Creek.....	2,400
Reedsburg, Hay Creek.....	1,200	French Creek.....	3,800
Twin Creek.....	1,800	French Creek, North Branch.....	1,400
Rhineland, Crescent Creek.....	800	French Creek, South Branch.....	1,400
Four Mile Creek.....	400	French Valley Creek.....	1,200
Jennie Creek.....	800	Holcomb Cooley Creek.....	1,200
Noisy Creek.....	1,200	Norway Valley Creek.....	1,200
River Falls, Kinnickinnic River.....	4,800	Pine Creek.....	1,200
Kinnickinnic River, Lower.....	1,200	Tamarack Creek.....	1,200
Kinnickinnic River, Upper.....	2,400	Turtle Lake, Beaver Creek.....	1,200
Kinnickinnic River, West Branch..	1,200	Clayton Bridge Creek.....	400
Salmo, Bark Creek.....	3,000	Lightning Creek.....	800
Brickyard Creek.....	3,000	Silver Creek.....	400
Lost Creek.....	2,000	Smith Creek.....	400
McDonald Creek.....	3,000	Turtle Creek.....	800
Onion River.....	3,000	Viroqua, Bad Ax River, North Fork..	400
Pikes Creek.....	3,000	Be-A-Bout Creek.....	400
Racket River.....	3,000	Bishop Creek.....	400
Ravine Park Creek.....	2,000	Brookville Creek.....	400
Redcliff Creek.....	3,000	Browns Creek.....	400
Sand River.....	4,000	Brush Hollow Creek.....	400
Siskiwit Creek.....	4,000	Carey Creek.....	800
Sheboygan Falls, Otter Creek.....	400	Cedar Creek.....	400
Rhine Creek.....	2,000	Cheatham Creek.....	400
Sparta, Ranch Creek.....	1,200	Connaway Creek.....	400
Spring Green, Jones Creek.....	400	Cook Creek.....	400
Stone Lake, Hay Creek.....	2,000	Duck Egg Creek.....	400
Sissibagama Creek.....	2,400	Elk Creek.....	400
Stoughton, Atkinson Creek.....	400	Getters Creek.....	400
Superior, Miles Creek.....	15,000	Harrison Creek, North.....	800
Upper Brule River.....	8,000	Harrison Creek, South.....	400
Tomah, Allen Creek.....	400	Pine Hollow Creek.....	400
Bear Creek.....	400	Purdy Creek.....	400
Big Squaw Creek.....	400	Reeds Creek.....	400
Brandy Creek.....	400	Rogers Creek.....	400
Brush Creek.....	400	Sees Creek.....	400
Coles Creek.....	400	Sidle Creek.....	400
Council Creek.....	400	Springville Creek.....	400
Dead Creek.....	400	Taintor Creek.....	400
Deer Creek.....	400	Willow Spring Creek.....	400
Dixon Creek.....	400	Waukesha, Baldwin Creek.....	400
Finger Creek.....	400	Bickwell Creek.....	400
Indian Creek.....	400	Blackwell Creek.....	400
Jennings Creek.....	400	Dopps Creek.....	400
La Flora Creek.....	400	Genesee Creek.....	400
Lemonweir Creek.....	400	Honeyager Creek.....	400
Little Squaw Creek.....	400	Keppens Creek.....	400
Lowe Creek.....	400	Rosenow Creek.....	800
Mill Creek.....	400	Salesville Creek.....	400
Mudd Creek.....	400	Scuppernong Creek.....	400
Sand Creek.....	400	Waterville Creek.....	400
Sandy Creek.....	800	Willow Creek.....	400
Silver Creek.....	400	Waupaca, Radley Creek.....	2,000
Sparta Creek.....	400	Wausau, Big Sandy Creek.....	334
Stony Creek.....	400	Black Creek.....	800
Swamp Creek.....	400	Bull Junior Creek.....	800
Thompson Creek.....	400	Cedar Creek.....	800

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## BROOK TROUT—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Wausau, Four Mile Creek.....	2,000	Wilton, Gallagher Creek.....	600
Little Trap Run.....	334	Kinney Valley Creek.....	600
Westby, Bad Ax River.....	400	Meyers Creek.....	600
Baglien Creek.....	400	Moore Creek.....	600
Bargs Creek.....	400	Posy Creek.....	600
Dahl Creek.....	400	Riordon Creek.....	600
Douse Creek.....	400	Sibke Creek.....	600
Dybing Creek.....	400	Sinks Creek.....	600
Ellefson Creek.....	400	Slayton Creek.....	600
Esofea Creek.....	600	Straightman Creek.....	600
Freming Creek.....	400	Walge Creek.....	600
Hanson Creek.....	400	Webb Creek.....	600
Helge Larson Creek.....	400	Winneboujou, Blueberry Creek.....	1,000
Helgeson Creek.....	400	Cusins Lake.....	1,000
Helseth Farm Creek.....	400	Glozes Creek.....	1,000
Hillside Creek.....	400	Hollbrook Creek.....	1,000
Hollins Creek.....	400	Lake Florence.....	†2,000
Holte Creek.....	400	Little Brule River.....	†3,000
Jenson Creek.....	600	Sandy Pond.....	†1,000
Langhus Creek.....	400	Saunders Pond.....	†1,000
Larson Creek.....	800	Stoney Pond.....	†1,000
Moller Creek.....	400	Wheatons Creek.....	2,000
Oium Creek.....	400	Winter, Allen Creek.....	400
Olson Creek.....	800	Casey Creek.....	800
Overhagen Creek.....	1,200	Deadmans Creek.....	800
Peterson Creek.....	400	Jennings Creek.....	400
Pierce Creek.....	400	Nap Stout Creek.....	400
Rentz Creek.....	400	Wyoming:	
Sandbakken Creek.....	400	Aladdin, Rocky Ford Creek.....	2,500
Sease Creek.....	400	Beulah, Sand Creek.....	4,500
Senling Creek.....	400	Silver Spring Branch.....	6,000
Shannon Creek.....	600	Cody, Anderson Creek.....	1,600
Sherve Creek.....	400	Shoshone River, South Fork.....	1,800
Skersmoen Creek.....	400	Lander, Bear Creek.....	5,000
Skough Creek.....	400	Beaver Creek.....	7,500
Spring Valley Creek.....	400	Big Popo Agie River.....	10,000
Stevenson Creek.....	600	Lander Creek.....	5,000
Sveen Creek.....	400	Rock Creek.....	7,500
Swenson Creek.....	400	Silas Creek.....	5,000
Timber Coolee Creek.....	400	Slate Creek.....	5,000
Tomten Creek.....	400	Willow Creek.....	7,500
Von Ruden Creek.....	400	Laramie, Hunt's lake.....	*50,000
Whitehall, Adams Creek.....	1,000	Manderson, East Tensleep Creek.....	1,600
Breed Creek.....	1,000	Misty Moon Lake.....	800
Caswell Creek.....	1,000	Willow Creek.....	1,200
Freeman Creek.....	1,000	Newcastle, Stockade Beaver Creek.....	2,000
Harlow Creek.....	1,000	Powell, Bitter Creek.....	600
Harnden Creek.....	1,000	Canyon Creek.....	400
Hensel Creek.....	1,000	Lake Creek.....	400
Kidder Creek.....	1,000	Line Creek.....	600
Libakken Creek.....	1,000	Little Rocky Creek.....	600
McKivergan Creek.....	1,000	Mae Wood Creek.....	400
Solsrud Creek.....	1,000	Owens Creek.....	200
Taylor Creek.....	1,000	Paint Creek.....	600
Webb Creek.....	1,000	Willow Creek.....	400
Wells Creek.....	1,000	Sage, Twin Creek.....	1,050
Wood Creek.....	1,000	Saratoga, Jack Creek.....	12,000
Wilton, Billings Creek.....	600	Lake Creek.....	33,000
Brush Creek.....	1,200	Japan: Kobe, Japanese Government.....	*100,000
Cold Spring Creek.....	600		
Cook Creek.....	1,200		
Dorset Creek.....	600		
Farmers Creek.....	600		
		Total.....	{ *935,600 †5,972,495 7,888,932

## SUNAPEE TROUT.

Disposition.	Number.
Vermont: Brattleboro, South Pond.....	†8,000

a Loss in transit, 6,000 fry; 900 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## GRAYLING.

Disposition.	Number.	Disposition.	Number.
California: San Francisco, San Gregoria Creek.....	*50,000	Montana—Continued.	
Colorado:		Willow Creek.....	†8,000
Antero, Antero Lake.....	†50,000	Glacier Park, Grinnell Creek.....	†32,000
Leadville, Arkansas River.....	†15,000	Middle Two Medicine Lake.....	†32,000
Twin Lakes.....	†15,000	St. Marys Lake.....	†32,000
Loveland, Big Thompson River.....	†30,000	Madison Lake, Madison Lake.....	†500,000
Michigan: Grayling, State fish commission.....	*50,000	Odell Creek, Odell Creek.....	†200,000
Montana:		Sappington, Jefferson River.....	†24,000
Belt, Belt Creek.....	†16,000	Whitefish, Lacy Creek.....	†24,000
Little Belt Creek.....	†16,000	New York: New Milford, Basherkill River.....	*25,000
Neil Creek.....	†8,000		
Otter Creek.....	†16,000	Total.....	{ *125,000 †1,078,000

## SMELT.

Maine:		Maine—Continued.	
Anson, Great Emden Pond.....	†4,000,000	Sullivan, Tunk Pond.....	†4,000,000
Belfast, Quantabacook Lake.....	†4,000,000	Waldo, Halfmoon and Mixer Ponds..	†4,000,000
Brooks, Randall Pond.....	†4,000,000		
Denham, Branch Pond.....	†600,000	Total.....	†28,000,000
Otis, Green Lake.....	†7,400,000		

PIKE AND PICKEREL.<sup>a</sup>

Illinois:		Minnesota—Continued.	
Dallas City, Lake Cooper.....	33	Richmond, Mississippi River.....	2,060
Galena, Mississippi River.....	8,100	Winona, Mississippi River.....	3,070
Iowa:		Wisconsin:	
Bellevue, Mississippi River.....	8,900	Fountain City, Mississippi River....	12,485
Fairport, Mississippi River.....	205	Genoa, Mississippi River.....	5,000
North McGregor, Mississippi River..	20,050	La Crosse, Mississippi River.....	21,500
Minnesota:		Trempealeau, Mississippi River.....	10,532
Homer, Mississippi River.....	10,762		
Lake City, Lake Pepin.....	946	Total.....	103,643

## FRESH-WATER DRUM.

Illinois: Galena, Mississippi River.....	1,200	Wisconsin—Continued.	
Iowa:		Genoa, Mississippi River.....	5,000
Bellevue, Mississippi River.....	1,875	La Crosse, Mississippi River.....	20,000
Fairport, Mississippi River.....	529	Lynxville, Mississippi River.....	1,000
Wisconsin:			
Fountain City, Mississippi River....	200	Total.....	29,804

## CRAPPIE AND STRAWBERRY BASS.

Alabama:		Colorado: Wray, Robb Lake.....	300
Anniston, Aquarium.....	35	Connecticut:	
Oxford Lake.....	70	Waterbury, Hill Pond.....	70
Birmingham, City Aquarium.....	20	Smith Pond.....	35
Dancy, Binion's pond.....	70	District of Columbia: Washington,	
Montgomery, Shooting Club Lake.....	70	Rhodmont Lake.....	40
Opelika, Edwards's pond.....	70	Florida:	
Sulligent, Maddox's pond.....	35	Orlando, Lake Florence.....	84
Arizona:		Lake Lucy.....	84
Douglas, Mulberry Pond.....	80	Lake Stanley.....	84
Globe, Roosevelt Lake.....	1,120	Georgia:	
Arkansas:		Cusseta, Shipp Place Pond.....	90
Black Rock, Black River.....	1,900	Greensboro, Richland Creek.....	25
Conway, Owen Lake.....	30	Mora, Walker's pond.....	50
Fayetteville, Davidson's pond.....	40	Stone Mountain, Venable Lake.....	100
White River, Middle Fork.....	100	Swainsboro, Rountree Pond.....	100
Genoa, Hall's pond.....	140	Tifton, Waterloo Pond.....	90
Little Rock, Spring Lake.....	140	Illinois:	
Morrilton, Earl's pond.....	35	Ava, Ava Springs Lake.....	80
Patmos, Lafferty's lake.....	140	Belleville, Fern Glen Lake.....	120
Russellville, Galla Creek.....	105	Carbondale, Lake Goodman.....	360

<sup>a</sup> The fish here listed were rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Illinois—Continued.</b>		<b>Kentucky—Continued.</b>	
Crystal Lake, Crystal Lake	1,200	Lexington, Le Bus's pond	40
Dallas City, Lake Cooper	1,104	Sink Hole Pond	40
East St. Louis, Cemetery Pond	120	Wallace Pond	80
Elizabeth, Apple River	300	Logans, Adams's pond	40
Farmer City, Salt Creek	35	Louisville, Floyd Fork	1,400
Galena, Mississippi River	a 93,000	Harrods Creek	1,400
Galesburg, City Lake	35	Landsdowne Lake	50
McComb, Ruebushe's pond	80	Sears Pond	175
Millington, Fox River	35	Maceo, Kingfisher Lake	1,000
Moline, Fower Pond	120	Owensboro, Lewis's pond	100
Pana, Converse's pond	120	Lyne's pond	100
Philadelphia, Faudi's pond	80	Shelbyville, Brown's pond	200
Philadelphia, Willow Pond	40	Clear Creek	600
Prairie du Rocher, Dinan's pond	80	Springfield, Neikirk's pond	40
Red Bud, Benzie Pond	80	Whitesburg, Rosedale Pond	40
Red Bud Lake	200	Williamsburg, Cumberland River	120
Shelbyville, Kaskaskia River	80	Winchester, True's pond	40
<b>Indiana:</b>		Witherspoon's pond	40
Corydon Junction, Diedrick's pond	100	<b>Louisiana:</b>	
Edinburg, Sugar Creek	175	Florien, Mill Creek	80
English, Little Blue River	400	Homer, McKenzie's pond	70
Indianapolis, Fan Lake	35	Myrtis, Mill Pond	80
White River	140	<b>Maryland:</b>	
La Grange, Blackman Lake	35	Frederick, Monocacy River	40
Cedar Lake	200	Seneca, Potomac River	a 350
Fish Lake	200	<b>Massachusetts:</b> Plymouth, South Tri-	
North Twin Lake	35	angle Pond	105
Oliver Lake	70	<b>Michigan:</b>	
Still Lake	200	Fabius, Clear Lake	105
Muncie, Gravel Pit Pond	35	Floodwood, Lily Lake	120
Lagoon Pond	35	Highland, Lakes in Oakland	
New Albany, Perrettes Lake	150	County	770
Peru, Eel River	70	Houghton, Fales Lake	160
Plymouth, Twin Lakes	70	Huron Pond	160
Portland, Bailey's pond	35	Indian River, Indian River	35
Ramsey, Bush's pond	100	Jackson, Big Portage Lake	70
Rome City, Sylvan Lake	70	Marquette, Deer Lake	120
Terre Haute, Gravel Pit Pond	160	Nashville, Willow Pond	35
Waynetown, Harvey's pond	35	Reed City, Lake Osceola	105
<b>Iowa:</b>		<b>Minnesota:</b>	
Bellevue, Mississippi River	a 180,875	Buffalo, Buffalo Lake	120
Boone, Des Moines River	90	Central Lakes, Augusta Lake	120
Corning, Nestling Water Pond	30	Degraff, St. Marys Lake	175
Vernon's pond	60	Forado, Union Lake	60
Eldora, Iowa River	180	Homer, Mississippi River	a 209,350
Fairport, Mississippi River	a 43,335	Lake City, Lake Pepin	a 13,325
Guthrie Center, Woodland Lake	35	Little Falls, Fish Lake	100
Manchester, Maquoketa River	3,090	Minneapolis, Cedar Lake	120
North McGregor, Mississippi River	a 261,000	Morristown, Pleasant View Pond	60
<b>Kansas:</b>		North Branch, Rice Lake	150
Baileyville, Anthony Far Pond	140	Owatonna, Lonergan Lake	60
Chanute, Allen Lake	1,000	Preston, Root River, Middle Branch	60
Edwardsville, Betts Creek	35	Root River, South Branch	60
Forest Club Lake	70	Richmond, Mississippi River	a 39,200
Marshall Creek	35	Rochester, Mill Pond	60
Mission Creek	35	Tamarack, Kelley Lake	100
Elk Falls, Elk River	105	Winona, Lake Winona	120
Kincaid, Grindstone Lake	35	Mississippi River	a 39,350
Pittsburg, Radels Pond	100	<b>Mississippi:</b>	
Shout's pond	100	Aberdeen, Baker Lake	140
Stanley, Rural Retreat Lake	70	Cantrell Lake	105
<b>Kentucky:</b>		Ackerman, Hemphill's pond	35
Anchorage, Spring Hill Lake	200	McKnight's pond	70
Brodhead, Dix River	80	Columbus, Owen Pond	35
Negro Creek	80	Corinth, Young's pond	70
Crab Orchard, Crab Orchard Lake	80	Crystal Springs, Batton's pond	105
Danville, Sallee's pond	40	Flora, Lipscomb's pond	70
Gatliff, Big Poplar Creek	40	Friar Point, Mississippi River	a 2,785
Georgetown, Hall's pond	40	Hazlehurst, Crystal Lake	80
North Elkhorn Creek	120	Fletcher's lake	105
Greensburg, Green River	160	Lake Hazel	140
Guthrie, Durham's pond	70	Marchetti's lake	65
Hodgenville, Walters's pond	80	Jackson, Spring Lake	175
Kuttawa, Cumberland River	a 4,921	Willow Pond	70
Lakeland, Hospital Lake	200	Kosciusko, Bailey Lake	175
Lawrenceburg, Marrs Lake	80	Meridian, Reed Brake Pond	35

a Rescued from overflowed lands and returned to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Mississippi—Continued.		Oklahoma—Continued.	
Pontotoc, Pontotoc Pond.....	125	Choteau, Adkins Lake.....	40
Quincy, Bird's pond.....	35	Nunley's pond.....	80
Senatobia, Mitchell's pond.....	70	Cushing, Fleming's pond.....	159
Water Valley, Otuckolofa Club Lake.....	105	Elgin, Sawin's pond.....	35
Missouri:		El Reno, Petrees Pond.....	35
Aurora, Honey Creek.....	300	Erick, Henke's pond.....	35
Baring, Baring Lake.....	200	Fallis, Lake Charles.....	53
Blackburn, Blackburn Pond.....	300	Frederick, Godard Lake.....	35
Bonnets Mill, Smith Lake.....	200	Prairie Spring Lake.....	35
Cabool, Graves's pond.....	100	Slack Lake.....	35
Cadet, Fountain Farm Pond.....	200	Goteba, Hinton Lake.....	35
Calhoun, Butler Lake.....	100	Minton Lake.....	35
Ferguson, Wabash Club Lake.....	608	Gould, Duncan's pond.....	35
Fortesque, Bigelow Lake.....	2,120	Grandfield, Cassidy's lake.....	35
Grandview, Berry Pond.....	100	Cottonwood Lake.....	35
Rollo Pond.....	100	Lake Willow.....	35
Kansas City, Weber's pond.....	100	Granite, Irion's pond.....	35
Lathrop, High Point Lake.....	300	Olds's pond.....	35
Lake Benson.....	400	Guthrie, Beets Lake.....	53
Lebanon, Mayfield's pond.....	150	Indian Lake.....	53
Lisle, Lisle Lake.....	600	Santa Fe Lake.....	53
Peirce City, Clear Creek.....	200	Seeley's lake.....	53
Pleasant Hill, Bond Lake.....	200	Williams Lake.....	53
Potosi, Mineral Fork Creek.....	200	Haworth, Hughes's pond.....	40
Rolla, Congressional Club Ponds.....	200	Hickory, Canyon Lake.....	53
Cowan's pond.....	100	Hobart, Bottom's pond.....	35
Lily Pond.....	200	Little Otter Creek.....	35
Ozark Lake.....	200	Terry Lake.....	70
New Mexico:		Hollis, Nell's pond.....	35
Artesia, Jerome's pond.....	40	Keystone, Dry Lake.....	53
Clayton, North Canyon Creek.....	80	Kiowa, Kiowa Katy Lake.....	120
Haswell, Blue Lake.....	240	Konawa, Autry's pond.....	53
Roswell, Haymaker's pond.....	40	Bates's pond (A).....	53
Lea Lake.....	40	Bates's pond (B).....	53
North Carolina:		Jumper Pond.....	53
Franklinton, Good Luck Pond.....	35	Maxwell's pond.....	53
Hendersonville, Maybank's lake.....	80	Lone Wolf, Carson's pond.....	35
Kinston, Carraway's pond.....	200	Poling's pond.....	35
Kittrell, Moore's pond.....	35	Loveland, Dumber Lake.....	35
Littleton, Johnston's pond.....	140	Mangum, Houpe's pond.....	35
Warren Pond.....	175	Lake Orth.....	105
Louisburg, Jackson Pond.....	35	Rocher's pond.....	35
Roseboro, Great Swamp Pond.....	40	Maramace, Maramace Lake.....	53
Winston-Salem, Lake Katherine.....	120	Pattison's pond.....	53
North Dakota:		Marlow, Roach Lake.....	35
Bottineau, Lake McArthur.....	300	Marshall, Otter Creek.....	35
Long Lake.....	300	Mountain View, Kendrick Pond.....	35
Loon Lake.....	300	Nast, Reid's pond.....	35
Devils Lake, Devils Lake.....	1,000	Newkirk, Club Pond.....	53
Ohio:		Railroad Lake.....	53
Cambridge, City Lake.....	120	Oklahoma City, Armor's pond.....	53
Tin Mill Pond.....	40	Sandringham Lake.....	53
Chillicothe, Paint Creek.....	160	Stanson's pond.....	53
Cincinnati, Chapman's pond.....	35	Oakwood, Mound Lake.....	35
Stone Lick Creek.....	105	Owasso, Silver Lake.....	53
Crestline, Sandusky River.....	105	Pawhuska, Bird Creek.....	53
Midland City, Lake Stanislaus.....	35	Bird Creek, North Fork.....	53
Morrow, Little Miami River.....	105	Perkins, Perkins Pond.....	53
Little Miami River, Todds Fork.....	105	Perry, Pagel's pond.....	53
St. Marys, Lake St. Marys.....	500	Sapulpa, Anderson's pond.....	53
Williamsburg, Little Miami River, East Fork.....	70	City Lake.....	53
Winchester, WhiteOak Creek.....	70	Euchre Lake.....	53
Oklahoma:		Meyer's pond.....	53
Ada, Shady Lake.....	40	Moses's pond.....	53
Agra, Robertson's pond.....	53	Rock Creek Pond.....	53
Altus, City Lake.....	70	Seminole, Grove Lake.....	53
Ardmore, Chickasaw Lake.....	120	Roscoe's pond.....	53
Club Lakes.....	160	Templeton's pond.....	106
Asher, White Lake.....	50	Shattuck, Ivanhoe Lake.....	105
Aydelot, Willow Lake.....	53	Shawnee, Blue Valley Pond.....	53
Bessie, Besler's pond.....	35	Karr Lake.....	53
Boley, Elm Lake.....	53	Maud Lake.....	53
Bristow, Jones's pond.....	53	Stillwater, Chandler's pond.....	53
Byars, Byars Lake.....	70	City Pond.....	53
Lake Halwawa.....	70	Deck's pond.....	53
Lake Peavine.....	70	Haskett Pond.....	53
Richards's pond.....	70	Kelly's pond.....	53
Cement, Cooper's pond.....	35	Lowry's pond.....	53
		Westbrook's pond.....	53

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Oklahoma—Continued.		Texas—Continued.	
Stillwater, Willow Lake.....	53	Detroit, Brickyard Pond.....	100
Yost Lake.....	53	Grasslands Pond.....	35
Stroud, Silver Pond.....	53	Edgewood, King's lake.....	100
Tecumseh, Drake Lake.....	53	El Paso, Cement Lake.....	70
Nichols Lake.....	53	Fort Worth, Fossil Lake.....	105
Parker Lake.....	53	Fruitvale, Hazel's pond.....	35
Santa Fe Lake.....	53	Gatesville, Leon River.....	210
Walter, Parish's pond.....	35	Plum Creek.....	70
Wanette, West's pond.....	53	Georgetown, San Gabriel River.....	300
Wilburton, Newsom's pond.....	40	Gilmer, Buio Lake.....	35
Pennsylvania:		Flag Lake.....	70
Altoona, Juniata River.....	120	Smith Lake.....	35
Ephrata, Cocalico Creek.....	80	Graford, Doan's pond.....	150
Lancaster, Conestoga Valley Pond.....	120	Rider Lake.....	150
Waterworks Pond.....	120	Grand Saline, Bermuda Grove Pond.....	35
La Plume, Keewanee Pond.....	80	Lake Wood.....	35
Manataka Pond.....	80	Grandview, Country Club Lake.....	300
Rushland, Neshaminy Creek.....	120	Grapeland, Clear Lake.....	35
Waterford, Lake LeBoeuf.....	80	Herods Lake.....	35
South Dakota:		Howard's pond.....	35
Lake Andes, Lake Andes.....	210	Spring Lake.....	35
Madison, Lake Madison.....	245	Round Lake.....	35
Pukwana, Red Lake.....	245	Greenville, City Pond.....	300
Scotland, James River.....	140	Hulsey's pond.....	100
Sioux Falls, Brant Lake.....	140	Hawkins, Little Sandy Club Lake.....	70
Tennessee:		Ireland, Laxson's pond.....	35
Collierville, Daffodil Pond.....	35	Jacksonville, Allis Lake.....	70
Estill Springs, Elk River.....	105	Alexander's lake.....	70
Elk River Mill Pond.....	70	Boles Lake.....	300
Hickory Valley, Terpedega Pond.....	80	Canon's lake.....	70
McMinnville, Barren Fork Creek.....	80	Sory's lake.....	70
Collins River.....	80	Jermyn, Roberts's pond.....	100
Memphis, Peter Pond.....	70	Jewett, Lake Estelle.....	35
Sink's pond.....	70	Kerryville, Guadalupe River.....	300
Milan, Black Jack Pond.....	70	Wahrmond's pond.....	30
Oliver Springs, Valley View Pond.....	80	Laredo, Wormses Pond.....	150
Shelbyville, Duck River.....	105	Longview Junction, T. & P. Lake.....	100
Tune's pond.....	70	Marshall, Annie Lake.....	150
Springfield, Babb's pond.....	70	Fern Leaf Lake.....	150
Red River, Sulphur Fork.....	70	Melvin, Valley Lake.....	35
Tellico Plains, Lake Tellico.....	80	Menard, Las Moras Creek.....	35
Texas:		San Saba River.....	105
Alvarado, Lake View.....	70	South Elm Creek.....	70
Annona, Snow Lake.....	83	Wallick Lake.....	35
Atlanta, Brush Pond.....	150	Water Hole Lake.....	35
Johnson's pond.....	100	Mesquite, Dallas Mesquite Lake.....	70
Bagwell, Gin Lake.....	100	Lake Hazel.....	70
Baird, Hancock's pond.....	70	Mineral Wells, Lake Pinto.....	150
Turner's pond.....	35	McCracken's pond (A).....	100
Big Springs, Lucian Wells Lake.....	35	McCracken's pond (B).....	100
Blossom, Brickyard Pond.....	150	Slaughter Creek.....	150
Bogata, Griffin Lake.....	150	Watson's pond.....	100
Bonham, Johns Estill Repose Lake.....	75	New Boston, McGee Lake.....	83
Steger's pond.....	75	Omaha, Hayes's pond.....	35
Burton, Jaroszesky's pond.....	100	Palestine, Bowen Lake.....	100
Watson's pond.....	100	Braughton Lake.....	75
Caldwell, Elizabeth Lake.....	35	Brush Lake.....	150
Gum Lake.....	35	East Side Park Lake.....	150
Hitchcock's pond.....	35	Elkhart Lake.....	105
Center Point, Guadalupe River.....	300	Guinn's pond.....	150
Clarksville, Allen's pond.....	60	Huff Lake.....	100
Country Club Lake.....	299	Leach Lake.....	150
Dimple Lake.....	35	Sand Lake.....	150
Red River Lake.....	249	Satine Lake.....	150
Comfort, Holiday Creek.....	150	South Side Lake.....	75
Corsicana, Derden's pond.....	35	Spring Lake.....	150
Frost Pond.....	35	Spring Park Lake.....	150
Magnolia Pond.....	35	Thomas Lake.....	150
Crockett, Beeson Pond.....	35	Willow Lake.....	300
Burton Lake.....	35	Paris, Crowley Pond.....	75
Frannon Lake.....	35	Holt's pond.....	100
Grannis Creek.....	35	Pearsall, Geyer's pond.....	50
Lake Mask.....	35	Petty, Beville's pond.....	75
Saterwhite's pond.....	35	Rutherford's pond.....	100
Smith Lake.....	70	Pilot Point, Peel's pond.....	100
Dallas, Highland Lake.....	100	Rock Crusher, Rock Crusher Lake.....	150
Del Rio, Devils River.....	140	Round Rock, Brushy Creek.....	105
Deport, Old West Brook Pond.....	100	Rugby, Griffin Lake.....	150
		Sabinal, Onion Creek.....	70

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Texas—Continued.</b>		<b>Wisconsin—Continued.</b>	
San Marcos, Cape's pond.....	200	Blair, Trempealeau Pond.....	300
Redwood Pond.....	48	Brokaw, Battle Creek.....	400
San Marcos River.....	4,000	Brokaw Pond.....	200
San Saba, Barnett Creek.....	35	Trapp River.....	400
Sherman, Vaden Lake.....	100	Cable, East Lake.....	300
Strawn, Palo Pinto Creek.....	70	Centuria, Poplar Lake.....	120
Terrell, Bond's pond.....	35	Donaldson, Porcupine Lake.....	50
Fletcher's pond.....	70	Fountain City, Mississippi River.....	a 194,660
Midland Lake.....	35	Genoa, Mississippi River.....	a 50,000
Texarkana, Davis Lake.....	150	Gordon, Bardon Lake.....	600
Spring Lake.....	150	La Crosse, Mississippi River.....	a 160,000
Tulia, Round Lake.....	150	Ladysmith, Bass Lake.....	200
Sunnyside Lake.....	150	Bucks Lake.....	200
Tyler, Chinquapin Lake.....	70	Lake Polaski.....	200
Hitts Mill Pond.....	70	Lake Stephenson.....	200
Rowland's pond.....	35	Lynxville, Mississippi River.....	a 5,000
Uvalde, Leona River.....	70	Menomonie, Cedar Lake.....	100
Nueces River.....	70	Hay River.....	100
Waco, Katy Lake.....	200	Lake Menomonie.....	100
Weatherford, Holland's lake.....	100	Manleys Bend Lake.....	100
Welfare, Joshua Creek.....	150	Moore Farm Lake.....	100
Willis, Howell's pond.....	35	Pitt Lake.....	100
Willis Point, Beauty Pond.....	100	Red Cedar River.....	100
Dodson Lake.....	100	Rowe Lake.....	100
Farm Lake.....	100	Stump Lake.....	100
Hamilton Lake.....	150	Nebagamon, Lake Nebagamon.....	600
Lake Allen.....	35	Norrie, Bass Lake.....	200
Lake Goodnight.....	100	Norrie Lake.....	200
Lake Howell.....	150	Pike Lake.....	200
Lake Osborne.....	150	Pine River, Pine River.....	400
Lake Perry.....	100	Rice Lake, Deer Lake.....	200
Lake Theodore.....	150	Desair Lake.....	200
Lake William.....	150	Island Lake.....	200
Moss Lake.....	100	Raspberry Lake.....	200
Williams Lake.....	100	Rice Lake.....	200
Willow Pond.....	100	Silver Lake.....	200
Woodland Lake.....	100	Spruce Lake.....	200
Winona, Butterfield's pond.....	35	Tuscolbia Lake.....	200
<b>Virginia:</b>		Schultz, Ackerman Lake.....	400
Burhans Wharf, Haley Mill Pond.....	200	Solon Springs, Lake St. Croix.....	600
Clarksville, Green Pond.....	80	Paradise Lake.....	600
Cullen, Robertson's pond.....	80	Sparta, Mission Bend Lake.....	300
Ford, Coleman's mill pond.....	80	Three Lakes, Little Moccasin Lake.....	50
Franklin City, Powell's mill pond.....	120	Tomahawk, Bass Lake.....	600
Front Royal, Barnett's pond.....	280	Trempealeau, Mississippi River.....	a 182,515
Glen Allen, Chickahominy Pond.....	40	Turtle Lake, Horseshoe Lake.....	200
Harrisonburg, Eversole Pond.....	40	Lower Turtle Lake.....	200
Meadow, Rosecrest Farm Pond.....	40	Silver Lake.....	100
Richmond, City Lakes.....	80	Upper Turtle Lake.....	100
Fulton Club Lake.....	80	Wascott, Red Lake.....	600
Waterview Pond.....	200	Wausau, Borax Creek.....	200
Yaley Mill Pond.....	80	Eau Claire River.....	400
Suffolk, Lake Darden.....	120	Gunmore Creek.....	200
Lake Savage.....	80	Lake Wausau.....	300
Neblett's pond.....	80	Rib Lake.....	200
The Plains, Goose Creek.....	300	Rib River.....	200
<b>West Virginia: Lochgelly, Williams's pond.....</b>	150	Road Lake.....	200
<b>Wisconsin:</b>		Short Portage Lake.....	200
Amery, Clare Lake.....	200	Wonewoc, Tank Pond.....	390
Wapogasset Lake.....	200		
Bennett, Lake Munising.....	600		
		Total b.....	1,565,072

## LARGEMOUTH BLACK BASS.

<b>Alabama:</b>		<b>Alabama—Continued.</b>	
Abbeville, McCall's Mill Pond.....	1,500	Brewton, Brickyard Pond.....	13,000
Alliceville, Cunningham Lake.....	1,000	Burnt Corn Creek.....	15,000
Gardner Lake.....	1,500	Canoe, Gordon Spring Pond.....	14,000
Ashby, Six Mile Creek.....	24	Carrollton, Central Springs Pond.....	60
Ashland, Axton Lake.....	1,000	Sapps Valley Lake.....	1,500
Birmingham, City Lake.....	40	Castleberry, Bell Pond.....	12,000
Brent, Tucker Pond.....	150	Thames Pond.....	12,000

a Rescued from overflowed lands and returned to original waters.

b Lost in transit, 1,156.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Alabama—Continued.		Alabama—Continued.	
Centerville, Avery Lake.....	600	Uniontown, Cherokee Pond.....	640
Cooper Lake.....	600	Vinegar Bend, Mill Pond.....	†3,000
Lightsey Lake.....	600	Wellington, Cowden's pond.....	†1,000
Coopers, Horse Creek.....	†2,000	York, Mellown's pond.....	†1,000
Courtland, Big Nance Creek.....	†5,000		1,000
Mountain Lake.....	†1,000		
Decatur, Beaver Lake.....	†4,000	Arizona:	
Swan Lake.....	†4,000	Flagstaff, Mormon Lake.....	120
Eoline, Hobson's pond.....	600	Geronimo, Wightman Ranch Lake.....	75
Eutaw, Choctaw Pond.....	1,000	Gleed, Horseshoe Pond.....	40
Evergreen, Cane Brake Creek.....	†4,000	Globe, Roosevelt Lake.....	700
Floral, Lake Jackson.....	1,500	Holbrook, Thomas's pond.....	25
Lake Williams.....	1,500	Morenci, Eagle River.....	175
Florence, Cypress Creek.....	†1,000	Winslow, Clear Creek.....	160
Fort Mitchell, Cantey's pond.....	64	Arkansas:	
Fort Payne, Little River.....	†2,000	Arlberg, Little Red River.....	300
Gastonburg, Vincent Pond.....	500	Atkins, Whiteside Pond.....	72
Geneva, Choctawhatchee River.....	1,500	Bellefonte, Crooked Creek.....	400
Goodwater, Goodwater Pond.....	1,500	Huzzah Creek.....	300
Gordon, Bazemore Mill Pond.....	1,500	Benton, Saline River.....	50
Gurley, Hurricane Creek.....	500	Black Rock, Black River.....	803
Headland, Shady Lake.....	3,000	Conway, Owen Lake.....	500
Three Corners Pond.....	2,000	Daggett, Cache River.....	100
Hillsboro, Quarry Pond.....	†2,000	Dardanelle, Oakdale Lake.....	120
Huntsville, Indian Creek.....	2,000	Earle, Lake Beautiful.....	315
Jacksonville, Browns Pond.....	2,500	Outzen's Lake.....	210
Jones, Kelly Pond.....	12	Edgemont, Little Red River.....	300
Lawley, Okmulgee Pond.....	600	Elba, Little Red River.....	300
Letohatchie, Bullock Pond.....	1,000	Elkins, Mountain Lake.....	35
Guy's pond.....	1,000	Fairmon, Fish Creek.....	60
Sanderson's pond.....	2,000	Fayetteville, Richland Creek.....	36
Lineville, Lake Mae.....	70	White River.....	48
Worthy's pond.....	†1,000	White River, Middle Fork.....	90
Lockhart, Still Pond.....	500	White River, West Fork.....	36
Luverne, Campbell's pond.....	250	Gilbert, Buffalo River.....	300
Kendrick-Ruff Lake.....	250	Harrison, Crooked Creek.....	200
McGehees, Shackelford's pond.....	1,000	Hartford, Boteau River, Jim Fork.....	40
Madison, James Pond.....	35	Heber Springs, Little Red River.....	460
Milstead, Mitchell Creek Pond.....	†2,000	Helena, Lake Solomon.....	40
Mobile, Deer River.....	†2,000	Higden, Little Red River.....	200
Montgomery, Crescent Lake.....	1,500	Hiwassee, Brinegar's pond.....	30
Hill Pond.....	1,000	Hughes, Belle Meade Lake.....	120
Montgomery Lake.....	5,000	Leslie, Little Red River.....	300
Shooting Club Lake.....	105	Little Rock, Spring Lake.....	72
Whetslenes Lake.....	1,500	Luna Landing, Lake Chicot.....	105
Mountain Creek, Arnold's pond.....	†2,000	Malvern, Baugh's pond.....	70
Onconta, Armstrong Creek.....	24	Miller, Little Red River.....	300
Black Warrior River.....	24	Oakvale, Little Red River.....	300
Opelika, Wetumpka Creek.....	†2,000	Ozark, Turner's pond.....	120
Ozark, Weeks's pond.....	250	Patmos, Lafferty Lake.....	90
Patsburg, McNeill's pond.....	250	Pine Bluff, Atkins Lake.....	120
Pine Hill, Indian Creek.....	400	Poe, Little Red River.....	600
Ramer, Collier's pond.....	†3,000	Rogers, Osage Creek.....	120
Harwell Pond.....	†1,000	Rottaken, Big Lake.....	150
Holmes's pond.....	†1,000	Clear Creek.....	100
Waller's pond.....	†4,000	Fourche Bayou.....	150
Riderwood, Lake Chocahona.....	200	Grassy Lake.....	24
Roanoke, Serover's pond.....	†3,000	Horseshoe Lake.....	21
Usery's pond.....	35	Kykendall Lake.....	100
Scottsboro, Gossett Creek.....	35	Lorance Creek.....	150
Selma, Harper-Melton Lake.....	300	Maple Creek.....	24
Silver Well Lake.....	12	Pennington Bayou.....	24
Speigner, Speigner Lake.....	†6,000	Wolf Bayou.....	24
Sprague, Duncan's pond.....	250	Rumley, Little Red River.....	300
Suggsville, Cedar Lake.....	750	Sandiff, Little Red River.....	300
Sulligent, Bogue Creek Pond.....	70	Scotts, Chenault Lake.....	150
Sulphur Springs, Lookout Creek.....	175	Fletcher Lake.....	200
Talladega, Mountain Creek.....	†3,000	Hill Lake.....	100
Troy, Bashinsky's pond.....	500	Horseshoe Lake.....	36
Cochran Mill Pond.....	1,550	Old River.....	150
Tyson, Farrior's pond.....	2,000	Pemberton Lake.....	100
Fleming Lake.....	1,000	Plum Bayou.....	36
Jones Lake.....	2,500	Scotts Bayou.....	100
Tyson Lake.....	2,000	Steele's lake.....	100
Williams Lake.....	1,500	Shirley, Little Red River.....	300
Union Springs, Mill Pond.....	64	Springdale, Brush Creek.....	90
Rosenstihl's pond.....	64	Walker Lake.....	90
		Walnut Spring Lake.....	60



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Arkansas—Continued.		Georgia—Continued.	
Stamps, Stamps Lake.....	48	Atlanta, Clara Meer Lake.....	475
Texarkana, Hubert Lake.....	20	East Lake.....	†4,000
Pine Dell Lake.....	30	Lake Wyanoke.....	3,000
Thornton, Pine Lake.....	50	Piedmont Park Lake.....	4,000
Toltec, Mound Lake.....	60	Augusta, Carmichael Pond.....	450
Waldo, Clear Lake.....	60	Austell, Sweetwater Creek.....	4,000
Grassy Lake.....	60	Beach, Moore's pond.....	150
Colorado:		Bellville, Briarwood Pond.....	500
Brandon, Chivington Lake.....	300	Bishop, Appalachee River.....	5,000
Calhan, South Butte Reservoir.....	95	Park Lake.....	1,500
Spring Pond.....	95	Blythe, Palmer Pond.....	100
Denver, Lakewood Lakes.....	95	Boneville, Johnson's pond.....	150
Durango, Animas River.....	246	Boston, Lako Pond.....	1,500
Fort Logan, Rucker Lake.....	380	Bowdon, Maple Pond.....	100
Haswell, Blue Lakes.....	500	Box Springs, Lake Mohignac.....	4,000
Holly, Bear Creek Pond.....	95	Bremen, Nelson's pond.....	2,000
East Slope Pond.....	95	Byron, Lower Pond.....	4,000
Johnston's pond.....	95	Cartersville, Callaway's mill pond.....	2,000
Lamar, Two Buttes Lake.....	1,425	Jackson Creek.....	3,000
Las Animas, Blue Lake.....	475	Jackson Mill Pond.....	2,000
Loveland, Southside Lake.....	40	Raccoon Creek.....	2,000
Nepesta, Dotson Lake.....	285	Reeves Lake.....	1,500
Nyburg, Setters Lake.....	285	Stamp Creek.....	3,000
Palmer Lake, Palmer Lake.....	100	Cecil, Kings Pond.....	1,000
Pueblo, Goodnight Pond.....	190	Chula, Pate Mill Pond.....	1,500
Hayden Lake.....	285	Cuthbert, Butler Pond.....	2,000
Rocky Ford, Sugar Club Lake.....	475	Coleman Pond.....	2,000
Salida, Davy Lake.....	190	Cox's pond.....	3,000
Sterling, Point of Rocks Lake.....	380	Davis's pond.....	3,000
Connecticut:		Hill's pond.....	2,000
Canaan, Long Pond.....	80	Hoods Pond.....	2,000
Twin Lakes.....	240	Wade's pond.....	2,000
East Lyme, Cedar Lake.....	120	Dacula, Alcoa River Pond.....	210
Patagausett Lake.....	120	Dalton, Swamp Creek.....	†3,000
Hartford, Mountain Creek.....	150	Eton, Holly Creek.....	3,000
Norwalk, Crystal Lake.....	100	Mill Creek.....	3,000
Tariffville, Nash Pond.....	150	Gibson, Smith Branch.....	500
Wallingford, Quanaupaug Lake.....	225	Greensboro, Bowden Pond.....	900
Waterbury, Pearl Lake.....	400	Griffin, Clearwater Pond.....	350
West Willington, Hockey Lake.....	200	Hahira, Gaskins's pond.....	1,200
Delaware:		Haralson, Swygert's pond.....	700
Delaware City, Scotch Run Lake.....	200	Hogansville, Flat Creek.....	3,000
Laurel, Records Lake.....	300	Jonesboro, Chambers Pond.....	3,000
Florida:		Jesters Old Mill Lake.....	4,000
Bartow, Lake Ann.....	1,000	Kibbee, Adams's pond.....	75
Lake Beula.....	1,000	Lake Park, Lake Francis.....	1,500
Lake Garfield.....	1,500	Ocean Pond.....	1,500
Bascom, Piney Pond.....	1,500	Zaret Pond.....	1,500
Davenport, Lake Buckeye.....	1,515	Lumpkin, Bladen Creek Pond.....	2,000
De Funiak Springs, Blue Pond.....	1,000	Perkins's pond.....	3,000
Florence Villa, Lake Conine.....	1,200	Womberly Mill Pond.....	2,000
Lake Eloise.....	1,200	McIntyre, Edgars Pond.....	2,000
Lake Fanny.....	1,200	Manchester, Manchester Mill Pond.....	3,000
Lake Hailton.....	1,200	Meigs, Farmer's pond.....	1,000
Lake Lucerne.....	1,000	Moultrie, Ladson's pond.....	2,000
Lake Smart.....	1,200	Ocilla, Paulk's pond.....	1,000
Lake Spring.....	1,200	Omaha, Brown Pond.....	2,000
Geneva, Buck Lake.....	2,000	Palmetto, Johnson's pond.....	2,000
Mohawk, Juanata Lake.....	2,000	Pavo, Adams Pond.....	2,500
Orlando, Big Sand Lake.....	2,500	Quitman, Blue Pond.....	1,000
Perry, Whiddon's pond.....	30	Raymond, Raymond Lake.....	6,000
Pine Castle, Lake Conway.....	3,000	Reidsville, Beasley's pond.....	500
Sebring, Lake Menon.....	1,070	Rockingham, Johnson Mill Pond.....	1,000
Lake Thelma.....	1,024	Rome, Rotary Lake.....	1,000
Summerfield, Little Lake Weir.....	2,000	Roseland Station, Brickyard Lake.....	4,000
Tallahassee, Buck Lake.....	1,750	Sandersville, Johnson's pond.....	100
Lake Hall.....	1,750	Screven, Brady's pond.....	1,500
Tampa, Strawberry Lake.....	1,500	Shellman, Crittenden's pond.....	1,500
Tavares, Lake Dora.....	500	Hart's pond.....	1,500
Windermere, Lake Butler.....	1,500	Siloam, Boswell's pond.....	300
Lake Downes.....	1,500	Social Circle, Stanton's pond.....	1,500
Georgia:		Sparta, Archer's pond.....	150
Alston, Southside Pond.....	1,000	Sycamore, Donohoo Gin Pond.....	500
Arlington, Plantation Pond.....	3,000	Trion, Riegel's pond.....	†3,000
Ashburn, Kerce Mill Pond.....	1,000	Round Pond.....	†1,000
Rock House Pond.....	1,000	Valdosta, Bentley Pond.....	1,000
Shingler's pond.....	800	Jo Rie Pond.....	1,500
Whiddon Lake.....	3,000	Varn's pond.....	2,000
Athens, Brooks's pond.....	1,000	Vidalia, Swift Creek.....	2,000

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Georgia—Continued.</b>		<b>Indiana—Continued.</b>	
Vienna, Gregory's pond.....	150	Crete, Jessup Mill Pond.....	200
Warm Springs, Thomas's pond.....	85	Culver, Lake Maxinkuckee.....	325
White Plains, Humphrey's pond.....	100	Dugger, Sunflower Lake.....	120
Jernigan's pond.....	600	Edinburg, Sugar Creek.....	200
Willacoochee, Clara Pond.....	75	English, Little Blue River.....	300
Fetcher's pond.....	1,500	Evansville, Evensmere Pond.....	700
Moore's pond.....	1,500	Infirmiry Lake.....	100
Paulk's pond.....	1,500	Greenfield, Sugar Creek.....	120
Woodbury, Betts Pond.....	12,000	Huntingburg, Ferdinand Lake.....	200
Wrens, Armstrong's pond.....	1,500	Indianapolis, Ben Hur Pond.....	80
Wrightsville, Onoospee Creek.....	300	Fall Creek.....	120
<b>Illinois:</b>		Kendallville, Tamarack Lake.....	150
Alpha, Crescent Lake.....	700	La Grange, Long Lake.....	150
Anna, Sitter's lake.....	290	Royer Lake.....	150
Apple River, Apple River.....	390	South Twin Lake.....	150
Barstow, Rock River.....	400	Largo, Wabash River.....	200
Belleville, Club Pond.....	300	Leesburg, Tippecanoe Lake.....	300
Brighton, Stubblefield Lake.....	120	Lena, Alma Pond.....	80
Brownfield, Rainbow Lake.....	300	Liberty, Lily Pond.....	40
Carterville, Crain Lake.....	600	Logansport, Kline's pond.....	75
Centralia, Lake Centralia.....	750	Lake Chicott.....	150
Chicago, Aquarium.....	25	Michigan City, Vail Mill Pond.....	80
Christopher, Harrison's pond.....	150	Milton, Butler Creek.....	80
Klein's pond.....	200	Martindale Creek.....	120
Council Hill, Fever River.....	224	Simons Creek.....	120
Crystal Lake, Crystal Lake.....	1,000	Whitewater River, Greens Fork.....	120
Dallas City, Lake Cooper.....	a 192	Whitewater River, Nolans Fork.....	120
Edwardsville, St. Clair Pond.....	1,000	Whitewater River, West Fork.....	120
Effingham, Ewington Pond.....	200	Monticello, Honey Creek.....	150
Elizabeth, Apple River.....	2,772	Pike Creek.....	150
Farmer City, Salt Creek.....	40	Muncie, Gravel Pit Pond.....	75
Farmington, Howell's pond.....	90	New Albany, Indian Creek.....	300
Franklin, Burlington Lake.....	120	New Carlisle, Hudson Lake.....	150
Galena, Mississippi River.....	a 8,000	Ockley, Gravel Pit Pond.....	75
Galesburg, City Lake.....	40	Otisco, Fourteen Mile Creek.....	300
Gilechrist, Continental Lake.....	300	Pendleton, Fall Creek.....	300
Hillsboro, Hill-Morrow Pond.....	60	Pierceton, Webster Lake.....	150
Irving, Wilson's pond.....	120	Plymouth, Pretty Lake.....	150
Iuka, Oakwood Lake.....	300	Ray, Clear Lake.....	225
Lebanon, Siegel's pond.....	300	Long Lake.....	150
Marshall, Spring Lake.....	60	Round Lake.....	150
Meredosia, Meredosia Bay.....	a 95	Rockport, Hoopole Creek.....	200
Millington, Fox River.....	80	Sellersburg, Belknap Lake.....	1,200
Moline, Power Pond.....	720	Globe Lake.....	400
Monmouth, Country Club Lake.....	90	Seymour, White River, East Fork.....	80
Illinois Central Pond.....	90	Terre Haute, Kolsem's pond.....	40
Murphysboro, Stecher's lake.....	80	Tipton, Shadyside Pond.....	40
Nora, Apple River.....	624	Valparaiso, Flint Lake.....	150
North Hanover, Apple River.....	308	Long Lake.....	150
O'Fallon, Birch Spring Pond.....	100	Veedsburg, Patton Lake.....	120
Red Bud, Red Bud Lake.....	300	Walcottville, Dallas Lake.....	150
Sylvan Lake.....	300	Walkerton, Koontz Lake.....	150
Rodden, Apple River.....	154	Walton, Kesling's pond.....	75
Roodhouse, City Reservoir.....	300	Washington, Zinkan's pond.....	40
Salem, City Lake.....	400	<b>Iowa:</b>	
Scales Mound, Fever River.....	312	Anamosa, Buffalo River.....	300
Shawneetown, Gregory Memorial Pond.....	150	Bellevue, Mississippi River.....	a 24,410
Okerson's mill pond.....	150	Boone, Des Moines River.....	240
Shelbyville, Kaskaskia River.....	40	Central City, Buffalo River.....	400
Stockton, Plum River.....	266	Clear Lake, Clear Lake.....	120
Trenton, Carr's pond.....	150	Creston, Summit Lake.....	200
Hanke's lake.....	300	Des Moines, Buxton Pond.....	60
Troy, Reider's pond.....	200	Eldora, Iowa River.....	240
Warren, Apple River.....	1,950	Fairfield, Adams's pond.....	80
<b>Indiana:</b>		Fairfield Pond.....	8,300
Alexandria, Englewood Pond.....	75	Fryman's pond.....	80
Angola, Loon Lake.....	150	Fairport, Mississippi River.....	a 6,349
Batesville, Waterworks Pond.....	120	Knoxville, City Pond.....	60
Bremen, Lake of the Woods.....	150	Lime Springs, Upper Iowa River.....	5,000
Bruceville, Brantlinger's pond.....	80	Manchester, Maquoketa River.....	1,000
Centerpoint, Steuerwald's pond.....	100	Maynard, Volga River, South Branch.....	60
Churubusco, Gandy Pond.....	100	Monticello, Maquoketa River.....	300
Corydon, Buck Creek.....	800	Nashua, Big Cedar River.....	120
Engleman's pond.....	100	Nevada, Dayton Park Lake.....	80
Silver Lake.....	400	North McGregor, Mississippi River.....	a 6,800
Crandall, Indian Creek.....	300	Onawa, Blue Lake.....	160
		Osceola, Rarike's pond.....	80

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Iowa—Continued.</b>		<b>Kentucky—Continued.</b>	
Steamboat Rock, Iowa River.....	240	Pembroke, Pendleton Lake.....	200
Story City, Lake Co-Mar.....	60	Providence, Luton Lake.....	200
Washington, Highland Park Lake.....	195	Shamrock Lake.....	200
West Burlington, Railroad Pond.....	325	Russellville, Davidson Pond.....	200
<b>Kansas:</b>		Edwards Pond.....	200
Chanute, Allen Lake.....	550	Flowers Pond.....	100
Edwardsville, Cement Lake.....	300	Parker Pond.....	100
Lake of the Forest.....	500	Perry's pond.....	100
Elk Falls, Elk River.....	130	Fulliam Pond.....	100
Fort Scott, Bridal Veil Lake.....	800	Simmons Pond.....	100
Sheeler Lake.....	1,000	Talley Pond.....	200
Girard, Allison's pond.....	200	Ryland, Club Pond.....	40
Havana, Santa Fe Lake.....	600	Stithon, White Lily Lake.....	800
Huron, Anthony Farm Pond.....	260	Vanarsdell, Bond's pond.....	40
Pittsburg, Embree Pond.....	450	Vanceburg, Kinnicomic Creek.....	300
Richmond, Santa Fe Lake.....	130	Whitesburg, Kentucky River.....	40
Soldiers Home, Lake Jeannette.....	65	Kentucky River, North Fork.....	40
Topeka, Berry Creek.....	300	<b>Louisiana:</b>	
Cedarcrest Lake.....	200	Bayou Sara, Magnolia Pond.....	{ †1,000
Deer Creek.....	305	Ethel, Greenbrier Lake.....	1,000
Mission Creek.....	300	Lake Lillian.....	100
<b>Kentucky:</b>		Lake Shannon.....	100
Allensville, Mosely Pond.....	200	Pretty Creek.....	†1,000
Anchorage, Reel's pond.....	20	Isabel, Sullivan's pond.....	200
Blackey, Kentucky River, North Fork.....	60	Keithville, Colquitt's pond.....	90
Rock House Creek.....	60	Lake Charles, King's pond.....	20
Brandenburg, Adams's pond.....	100	Leesville, Langton Mill Pond.....	30
Algood's pond.....	100	New Orleans, Westwego Lake.....	200
Cain Pond.....	100	Oaklawn, Bayou Lacombe.....	400
Dowden's pond.....	200	South Point, Irish Lake.....	400
Fontaine's pond.....	100	<b>Maine:</b>	
Hunter's pond.....	200	Augusta, Kearns's pond.....	50
Link's pond.....	100	Livermore Falls, Tilton Pond.....	225
McIntire's pond.....	100	<b>Maryland:</b>	
Moreman's pond (A).....	100	Antietam, Antietam Creek.....	60
Moreman's pond (B).....	100	Baltimore, Waxter Lake.....	120
Reed's pond.....	100	Boring, Piney Run.....	120
Richardson's pond.....	100	Bradshaw, Little Gunpowder Falls Creek.....	60
Sims Pond.....	100	Cumberland, Everts Creek.....	100
Butler, People's pond.....	40	Flintstone Creek.....	100
Cadiz, Little River, Sinking Fork.....	500	Potomac River.....	400
Campbellsville, Rice's lake.....	40	Detour, Double Pipe Creek.....	40
East View, Nolin River.....	40	Easton, Peach Blossom Creek.....	40
Ekron, Albert Lake.....	100	Glencoe, Gunpowder River.....	150
Clear Lake.....	100	Grimes, Potomac River.....	80
Doe Run Creek.....	200	Hagerstown, Antietam Creek.....	80
Isaac Pond.....	100	Conococheague Creek.....	80
Lily Pond.....	100	Harmans, Blue Pond.....	20
Sunrise Lake.....	100	Joppa, Oakdale Lake.....	20
Franklin, Peden Pond.....	200	Keedysville, Antietam Creek.....	120
Georgetown, Hall's pond.....	20	Marlboro, Fair Association Lake.....	120
North Elkhorn Creek.....	40	Motters Station, Toms Creek.....	60
Glasgow, Baird's pond.....	100	Odenton, Rogues Harbor Creek.....	40
Jones's pond.....	300	Phoenix, Phoenix Pond.....	100
Gracey, Wilson Pond.....	100	Salisbury, Leonard Mill Pond.....	40
Greensburg, Green River.....	40	Seneca, Potomac River.....	700
Guthrie, Bland's pond.....	100	Smithsburg, Antietam Creek.....	40
Hodgenville, McDowell's pond.....	400	Snow Hill, Purnell Pond.....	120
Hopkinsville, Hayes Pond.....	200	<b>Massachusetts:</b>	
Kildav, Cumberland River, Clover Fork.....	60	Graniteville, Burgess Pond.....	120
Kuttawa, Cumberland River.....	136	Huntington, Little Galilee Pond.....	200
La Grange, Royal Inn Lake.....	20	Lowell, Concord River.....	300
Lakeland, Hospital Lake.....	50	Flushing Pond.....	80
Louisville, Cedar Springs Lake.....	1,260	Hart Pond.....	155
Floyds Fork.....	44	Nabnasset Pond.....	80
Harrods Creek.....	44	Plymouth, South Triangle Pond.....	140
McBrayer, Salt River.....	40	<b>Michigan:</b>	
Madisonville, City Lakes.....	400	Au Sable, Crooked Lake.....	150
Mount Sterling, Bush Pond.....	40	Bellaire, Grass Lake.....	225
Tipton's pond.....	20	Channing, Silver Lake.....	60
Munfordville, Green River.....	20	Charlotte, Narrow Lake.....	80
Newport, Wirsch's pond.....	40	Clyde, Clay Lake.....	200
Otter Pond, Glover's pond.....	300	Crystal Falls, Erickson Lake.....	60
Paris, Airdre Lake.....	20	Floodwood, Floodwood Lakes.....	60
North Lake.....	40	Hart, Gilbert Lake.....	80
Woodlawn Lake.....	20	Juniper Pond.....	75
Xalapa Farm Pond.....	20	Highland, Lakes in Oakland County.....	2,000

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Michigan—Continued.</b>		<b>Minnesota—Continued.</b>	
Houghton, Big Bayou.....	40	Mahtowah, Park Lake.....	500
Hall Lake.....	60	Menahga, Morgan Lake.....	340
Lake Roland.....	60	Minneapolis, Lake Harriet.....	500
Snake River.....	40	Lake of the Isles.....	500
Iron Mountain, Long Lake.....	60	Norwood, Hyde Lake.....	340
Second Powder Lake.....	75	Owatonna, Beaver Lake.....	75
Trepanier Lake.....	40	Park Rapids, Lake Itasca.....	510
Iron River, Chicago Lake.....	170	Pelican Rapids, Lake Lizzie.....	520
Indian Lake.....	170	Pipestone, Crooked Lake.....	200
Jackson, Browns Lake.....	80	Preston, Root River.....	500
Jones, Bair Lake.....	80	Root River, North Branch.....	500
Birch Lake.....	80	Root River, South Branch.....	100
Driskell Lake.....	80	Rochester, Lake Shady.....	500
Poe's pond.....	40	Zumbro River, South Branch.....	500
Lakeland, Strawberry Lake.....	150	Rollins, Bear Lake.....	400
Leonard, Echo Lake.....	225	Hardy Lake.....	75
Marquette, Campan Lake.....	60	Moose Lake.....	400
Echo Lake.....	60	White Lake.....	400
Mud Lake.....	60	St. Cloud, Nina Creek.....	255
Vans Lake.....	60	St. Peter, Lake Emily.....	400
Whetmore Lake.....	60	Lake Jefferson.....	450
Whiteville Pond.....	80	Lake Washington.....	400
Marshall, Lyon Lake.....	80	Turney, Schelin Lake.....	75
Mass, Courtney Lake.....	60	Underwood, Olson Lake.....	340
Metropolitan, Norway Lake.....	60	Wanless, Harriet Lake.....	75
Six Mile Lake.....	60	Waseca, Goose Lake.....	300
Michigamme, Michigamme Lake.....	300	Rice Lake.....	300
Negaunee, Forbs Lake.....	60	Walkins Lake.....	300
Northville, Walled Lake.....	80	Winona, Biesanz's pond.....	200
Rockland, Nulhegan Pond.....	40	Lake Winona.....	400
Sagola, Norway Lake.....	60	Mississippi River.....	a 4,690
Scottville, Crystal Lake.....	80	<b>Mississippi:</b>	
Pere Marquette River.....	80	Aberdeen, Baker Lake.....	35
Sidnaw, Big Clearwater Lake.....	60	Hatch Lake.....	†4,000
Long Lake.....	60	Old Glory Pond.....	225
Loon Lake.....	60	Plantation Lake.....	†2,000
Wolf Lake.....	60	Roberts's lake.....	†3,000
South Branch, Jose Lake.....	225	Algoma, Moorman's pond.....	†1,000
South Range, Peters Lake.....	60	Amory, Fuqua Lake.....	†2,000
Three Oaks, Spring Lake.....	40	Jandon Pond.....	500
Toivola, Stamington Lake.....	60	Kinney Pond.....	†6,000
Watersmeet, Duck Lake.....	170		†2,000
Marion Lake.....	170	Artesia, Sclater's pond.....	15
White Cloud, Long Lake.....	80	Becker, McCullen's pond.....	†2,000
Winona, Ki-mit-a-wan-gag Lake.....	60	Bogue Chitto, Big Creek.....	450
Witch Lake, Fence Lake.....	60	Booneville, Booneville Lake.....	†4,500
Long Lake.....	40	Mason's pond.....	45
Lotta Lake.....	40	Brandon, Ainsworth Mill Pond.....	†2,000
Woodland, Saddle Bag Lake.....	150	Buckatama, Robinson's pond.....	75
<b>Minnesota:</b>		Bude, Lake Snyder.....	1,000
Brainerd, Wise's lake.....	500	Byram, Woods Pond.....	100
Buffalo, Buffalo lake.....	100	Calhoun City Weeping Willow Pond.....	†1,000
Twin Lakes.....	340	Cedar Bluff, Bellevue Pond.....	†2,000
Chisholm, Dewey-McCormick Lake.....	700	Gillilan's pond.....	110
Degraff, St. Marys Lake.....	340	Sanders Lake.....	†2,000
Detroit, Detroit Lake.....	425	Clinton, Harding's pond.....	500
Twin Lakes.....	75	Columbia, Reeves Lake.....	400
Duluth, Camp Lake.....	400	Columbus, Bylaw Lake.....	†3,000
Cook Lake.....	600	Lake Katherine.....	†4,000
Spring Lake.....	75	Corinth, Cane Creek Lake.....	†1,500
Erskine, Spring Lake.....	500	Clay Boone Lake.....	†1,500
Eveleth, Cedar Island Lake.....	300	Clear Lake.....	60
Fairmont, Bud Lake.....	400	Dyer Lake.....	45
Hall Lake.....	400	Hamlin Lake.....	45
Imogene Lake.....	300	Horn's pond.....	†1,500
Faribault, Willings Lake.....	340	Crawford, Pine Pond.....	15
Fertile, Olson Lake.....	400	Crystal Springs, Patton's pond.....	150
Grand Lake, Sunset Lake.....	400	Bridgeville Lake.....	300
Grand Meadow, Deer Creek.....	400	Palmer's pond.....	300
Highland, Stewart Lake.....	500	Slay's pond.....	450
Homer, Mississippi River.....	a 7,796	Derma, Hutchins's pond.....	†1,000
Knife River, Nigadoo Lake.....	a 2,970	Duck Hill, Oliver's pond.....	†2,000
Lake City, Lake Pepin.....	500	Fayette, Corban's pond.....	1,000
Lindstrom, Chesago Lakes.....	300	Flora, Big Pond.....	†1,000
Little Falls, Fish Lake.....	400	Gardner's pond.....	†1,000
Round Lake.....	300	Hopson's pond.....	200
Long Prairie, Lake Henry.....	425		

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Mississippi—Continued.		Mississippi—Continued.	
Frarspoint, Mississippi River.....	a 100	Starkville, Lewis Pond.....	{ \$2,000 100
Greenville, Mississippi River.....	a 140	McCright's pond.....	\$3,000
Grenada, Eureka Lake.....	400	Old Scout Club Lake.....	\$3,000
Hattiesburg, Lumber Company Pond.....	\$1,000	Pearson's pond.....	\$1,000
Hazlehurst, Hargrave Lake.....	450	Saunders' pond.....	110
Norman's pond.....	450	Valley Hill Pond.....	\$1,000
Peel's lake.....	800	Stratton, Cleveland's pond.....	\$1,000
Tally Lake.....	450	Summerland, Gambrel's pond.....	\$2,000
High Point, Eubank's pond.....	\$2,000	Sumrall, Miller's pond.....	\$2,000
Harden's pond.....	\$2,000	Tomnolen, Watson's pond (A).....	110
Jackson, Bailey Lake.....	\$2,000	Watson's pond (B).....	\$2,000
Emergency Pond.....	100	Watson's pond (C).....	\$2,000
Long Lake.....	\$2,000	Tupelo, Clover Lake.....	500
McClelland's pond.....	\$1,000	Dozier's pond.....	25
Magee's pond.....	\$3,000	Lake View.....	1,000
Raine's pond.....	\$3,000	Lespedeza Pond.....	500
Spring Lake.....	\$3,000	Riley's pond.....	1,000
Watkins Lake.....	80	Yates's pond.....	50
Kosciusko, Bailey Lake.....	125	Union, Jersey Brook Farm Pond.....	250
Furr's pond.....	110	Tidwell's pond.....	{ \$1,000 500
Moore's pond.....	25	Utica, Broome's pond (A).....	1,000
Lexington, Willow Castle Lake.....	\$1,000	Broome's pond (B).....	500
Louin, Land's pond.....	{ 500	Fulgham's pond.....	500
McComb, Clear Creek Lake.....	400	Water Valley, Kelley's pond.....	\$4,000
Reeves's pond.....	1,000	Shannon Mill Pond.....	\$2,000
McCool, Smith Pond.....	\$1,000	Trusty's pond.....	\$2,000
Veal Lake.....	\$3,000	Woodville, Sessions's pond.....	1,000
Maben, Lunceford's pond.....	\$2,000	Missouri:	
Templeton's pond.....	\$2,000	Aurora, Flat Creek.....	\$450
Macon, Flora's pond.....	15	Baring, Baring Lake.....	90
Howards Lake.....	30	Bunceton, Petite Saline Creek.....	300
Meadow Lake.....	\$2,000	Cabool, Indian Creek.....	210
Thomas's pond.....	15	Piney River.....	280
Magnolia, Minnehaha Creek.....	1,000	Roubidoux River.....	280
Meridian, Queen City Pond.....	15	Calhoun, Tibo Creek.....	140
Sharpe Lake.....	\$6,000	Chilhowee, Casey Lake.....	450
Mize, Butler's pond.....	\$3,000	Cottonwood Lake.....	200
Smith's pond.....	200	Honey Creek.....	450
Natchez, Field's pond.....	1,000	Clinton, Fish Lake.....	750
New Albany, Coker's pond.....	\$1,000	Shirt Lake.....	450
Robbins Lake.....	\$2,000	Crane, Lancaster Lake.....	140
Robbins Pond.....	\$2,000	Deepwater, Dickey Lake.....	140
Newton, Bounds's pond.....	1,000	Dodson, Oakwood Lake.....	590
Okolona, Club Lake.....	\$2,000	Ferguson, Wabash Club Lake.....	280
Penn, Lake Marguerite.....	\$4,000	Fortescue, Big Lake.....	400
Pheba, Champion's pond.....	\$2,000	Higginsville, Tyler Spring Pond.....	150
Philadelphia, Cox's pond.....	\$1,000	Holmes Park, Bass Lake.....	400
King's pond.....	\$1,000	Independence, Bitter Sweet Lake.....	500
Picayune, East Hobolochitto Creek.....	500	Cliff Lake.....	500
McLaughlin's pond.....	500	Compton Lake.....	1,000
Smith's pond.....	1,500	Dickinson Lake.....	300
Stockstill's pond.....	1,500	Harris's pond.....	400
Tate's lake.....	1,500	Jasper, Possum Creek.....	200
Telle Pond.....	500	Joplin, Bunce's pond.....	400
West Hobolochitto Creek.....	500	Five Mile Lake.....	450
Pocahontas, Lane's pond.....	\$3,000	Thomas Lakes.....	200
Pearl River.....	\$3,000	Kansas City, Lake of the Woods.....	600
Riverside Pond.....	\$2,000	Rookwood Pond.....	300
Pontotoc, Moss Lake Pond.....	\$1,000	Shadow Lake.....	600
Primrose Lake.....	\$2,000	Lamar, Gregory Lake.....	200
Port Gibson, Ellis Lake.....	1,500	Muddy Creek.....	600
Oil Works Pond.....	1,000	Spring River, North Fork.....	900
Roxie, Campbell's pond.....	1,000	Wilson's pond.....	150
Sallis, Clanton's pond.....	\$2,000	Lanagan, Big Sugar Creek.....	450
Shuler's pond.....	\$1,000	Lebanon, Browns Lake.....	150
Scobba, Stewart's pond.....	\$3,000	Gasconade River.....	400
Sessums, Castle's pond.....	\$1,000	Lisle, Lisle Lake.....	300
Shuqualak, Anderson's pond.....	\$1,000	Marceline, Santa Fe Lake.....	210
Ivy's pond.....	\$1,000	Nevada, Katy Allen Lake.....	450
Perry's pond.....	\$1,000	Radio Springs Lake.....	600
Steel's pond.....	\$2,000	West Lake.....	450
Spring Lake.....	\$3,000	Noel, Elk River.....	140
Starkville, Benton's pond.....	a 35	Northview, James River.....	286
Fort Pond.....	110	Odessa, Lake Venita.....	210
Hamm's pond.....	\$2,000		

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Missouri—Continued.		New York—Continued.	
Pleasant Hill, Anglers Club Lake...	200	Randolph, Stillwater Pond.....	100
Bond's lake.....	650	Red Creek, Blind Sodus Bay.....	400
Leonards Lake.....	450	Salisbury, Beaverdam Lake.....	400
Smith Lake.....	450	Thompsons Ridge, Plattekill Creek.	200
Saginaw, Morsman Lake.....	†500	Shawangunkkill Creek.....	300
St. James, Meramec River.....	600	Troy, Three Lakes.....	400
Sedalia, Spring Fork Creek.....	200	Tully, Tully Lake.....	*400
Slater, Alton-Slater Pond.....	343	North Carolina:	
Cattail Lake.....	200	Aberdeen, Maries Pond.....	400
Warrensburg, Willow Lake.....	200	Millies Pond.....	800
West Plains, Spring River, tributary		Angier, Gardner's pond.....	600
of.....	240	Ashboro, Parker's pond.....	75
Willow Springs, Frisco Lake.....	360	Benson, Hall's pond.....	25
Windsor, Wilkerson Park Club Pond	600	Stephenson's pond.....	†1,000
Montana:		Bowie, New River.....	60
Bynum, Muddy River.....	500	Old Field Creek.....	15
Stukey's pond.....	300	Brevard, Bridge Creek.....	†500
Forsyth, Yellowstone River.....	7,500	Tucker Creek.....	†500
New Hampshire:		Cameron, Crane Creek.....	30
Keene, Spofford Lake.....	160	Cary, Holleman's pond.....	†1,000
Newport, Rockybound Pond.....	225	Chalybeate, Spence's pond.....	450
New Jersey:		Charlotte, City Park Pond.....	400
Branchville, Culver Lake.....	400	Grandy's pond.....	400
Camden, Willow Grove Lake.....	400	Lakewood Park Lake.....	400
Cranford, Bloodgood Pond.....	200	Orr's pond.....	400
Newfoundland, Green Pond.....	400	Clarkton, Dutch Branch Pond.....	300
Picatunny, Picatunny Lake.....	400	Clayton, White Oak Pond.....	30
Plainfield, Holly Park Lake.....	300	Climax, Cohlers Pond.....	250
Seeley Pond.....	300	Concord, Allison Pond.....	600
Princeton, Carnegie Lake.....	800	Dutch Buffalo Creek.....	600
Ridgewood, Saddle River.....	400	Conway, Watson's pond.....	400
Trenton, Hutchinson Lake.....	600	Doughton, Doughton Creek.....	45
New Mexico:		Dunn, Great Coheria Pond.....	1,200
Abbott, Abbott Lake.....	120	Jernigan's pond.....	400
Alamillo, Alamillo Lake.....	75	Edenton, Queene Anne Creek.....	6,000
Isla Pond.....	25	Elkin, Bugaboo Creek.....	†500
San Acacia Lake.....	75	Carter Falls Pond.....	†500
Chama, Canones Lake.....	90	Elkin Creek.....	†500
Clayton, El Rito Lake.....	50	Yadkin River.....	†500
Engle, Engle Lake.....	200	Ellerbe, Bells Creek Pond.....	2,000
Raywood, Warm Springs Pond.....	150	Howell's pond.....	1,500
Lakewood, Lake McMillan.....	100	Mountain Creek.....	2,000
Las Vegas, Asylum Lakes.....	50	Elm City, Moore's pond.....	300
Gallegos Pond.....	40	Enfield, Sycamore Pond.....	400
Maxwell, Lagonia Medara Lake.....	75	Fayetteville, Beaver Lake.....	†2,400
Lake Thirteen.....	75	Little Rockfish Pond.....	†2,500
Onava, Armstrong Lakes.....	75	Mill Pond.....	†2,400
Deep Lake.....	75	Sand Hill Pond.....	45
Raton, Throttle Pond.....	50	Franklinton, Wilder's pond.....	15
Roswell, Club Lake.....	25	Fuqua Springs, Powell's pond.....	†1,300
Santa Fe, Arroya Hondo Lake.....	25	Greensboro, Hamburg Mill Pond.....	1,000
Tesuque Lake.....	25	Little Alamance Creek.....	30
Santa Rita, Harris's pond.....	150	Monroe's pond.....	15
Taos, Marez's pond.....	80	Pinedale Pond.....	30
Thoreau, Indian Pond.....	25	Hendersonville, Hayne's pond.....	†1,000
New York:		Jordan's pond.....	†500
Altamont, Normankill Creek.....	300	Lake Wajaw.....	†500
Thompson Lake.....	600	Penny's pond.....	†500
Warner Lake.....	300	Hickory, Baker Mountain Ponds.....	†500
Au Sable, Fern Lake.....	300	Catawba River.....	†500
Selmer Lake.....	200	Catawba River, Jacobs Fork.....	†500
Bridgehampton, Long Pond.....	200	Gunpowder Lake.....	45
Cambridge, Hedges Lake.....	400	Hillsboro, Eno River.....	500
Lake Lauderdale.....	400	Jackson Springs, Harris's pond.....	1,500
Clymer Station, Clymer Pond.....	200	Kinston, Sitterson's pond.....	30
Eaton, Hatches Lake.....	400	La Grange, Bear Creek Pond.....	1,000
Hopkins Lake.....	400	Sutton's pond.....	600
Ellenville, Ulster Lake.....	400	Laurel Hill, Pate's pond.....	400
Fulton, Lake Nehtawanta.....	400	Leland, Pennys Pond.....	600
Gansevoort, Old Chase Pond.....	200	Lilesville, Cloud Lake.....	450
Greenwood Lake, Greenwood Lake.....	400	Harris's pond.....	400
Hannibal, Glendale Pond.....	200	Littleton, Warren Pond.....	30
La Grangeville, Beechmont Pond.....	200	Louisburg, Tar River.....	25
Lake Mahopac, Kirk Lake.....	500	Marshville, Fennell Pond.....	200
Little York, Goodale Lake.....	400	Flow Pond.....	400
Little York Lake.....	400	Griffin View Pond.....	200
Lyons, Ganargua Creek.....	400	Hargett's pond.....	400
Pine Bush, Shawangunkkill Creek.....	300	March's pond.....	400

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>North Carolina—Continued.</b>		<b>Ohio—Continued.</b>	
Monroe, Austin's pond.....	400	Berea, Deer Quarry Pond.....	200
Fairview Pond.....	200	Cambridge, City Lake.....	225
Grassy Island Pond.....	400	Tin Mill Pond.....	25
Simpson's pond.....	200	Canton, Meyers Lake.....	300
Morrisville, Sorrell's pond.....	15	Carey, Fish Club Lake.....	400
Sycamore Creek.....	800	Chillicothe, Paint Creek.....	400
Murphy, Hanging Dog Creek.....	500	Paint Creek, North Fork.....	280
New Bern, Hancock Creek.....	600	Chippewa Lake, Chippewa Lake.....	500
Trent River.....	500	Cincinnati, Lake Kaelin.....	120
New Hill, Maple Branch Pond.....	†1,000	Mill Creek Lake.....	40
Old Fort, Catawba River.....	†500	Cleveland, Bass Lake.....	300
Oriental, Dawson Creek.....	45	Punderson Lake.....	300
Green Creek.....	300	Snow Lake.....	300
Pendleton, Stephenson-Sykes Mill Pond.....	1,000	Covington, Stillwater River.....	25
Pilot Mountain, Dodson Mill Pond.....	360	Crestline, Sandusky River.....	300
Pineville, Little Steel Creek.....	25	Dayton, Burkhardt's pond.....	120
Raeford, Juniper Creek.....	200	Lewisburg, Miller Fork Creek.....	195
Raleigh, Batts's pond.....	400	Twin Creek.....	260
Rockingham, Covington's pond.....	400	Logan, Clear Fork Creek.....	75
Leak Pond.....	400	Scott Creek.....	75
Ledbetter Pond.....	600	Mansfield, Brubaker Creek.....	200
Marks Creek.....	800	Clear Fork Creek, North Branch.....	300
Pee Dee Mill Pond.....	600	Clear Fork Creek, South Branch.....	300
Sleeter Mill Pond.....	400	Ferguson Creek.....	200
Speed Creek Pond.....	700	Kohiser Creek.....	200
Roduco, Jones Mill Pond.....	400	Rocky Fork Creek.....	300
Rougemont, Bowling Mill Pond.....	†500	Stevenson Run.....	100
Roxboro, Gregory's pond.....	†500	Whetstone Creek.....	400
Hester's pond.....	25	Marietta, Duck Creek.....	75
Sanford, Carvington Pond.....	†1,500	Little Muskingum River.....	75
Gonnella Pond.....	†1,500	Millersburg, Killbuck River.....	75
Troyens Pond.....	†1,500	Ney, Mason's pond.....	100
Shoals, Benham Pond.....	250	Oak Harbor, Portage River.....	300
Halls Pond.....	†500	Piqua, Spring Creek.....	50
Kittle Creek.....	†500	Quaker City, Wills Creek.....	75
Matthews's pond.....	†500	Randall, Sand Rock Pond.....	200
Shoals Creek.....	†500	St. Marys, Lake St. Marys.....	125
Spout Springs, Mill Pond.....	500	Shelby, Huron River.....	300
Statesville, White Oak Pond.....	15	Mohican River, Black Fork.....	300
Sunbury, Cross Mill Pond.....	500	Sidney, Tanawa Lake.....	75
Sylva, Tuckaseegee River.....	†500	Swifts, Muskingum River.....	75
Tarboro, Lake Parker.....	900	Tiffin, Mohawk Club Lake.....	500
Tar River.....	75	Troy, Honey Creek.....	75
Wake Forest, Caddell's pond.....	600	Spring Creek.....	150
Warsaw, Cooper Mill Pond.....	600	Unionville, Rock's pond.....	100
Nahunga Club Pond.....	600	Wapakoneta, Auglaize River.....	75
Waxhaw, Six Mile Creek.....	100	Grand Lake.....	100
Whiteville, White Pond.....	150	Washington Court House, Carman's pond.....	80
Wilmington, Buena Vista Pond.....	200	Clouser's pond.....	40
Orton Pond.....	500	Paint Creek, East Fork.....	80
Wingate, Stewart's pond.....	30	Rattlesnake Creek.....	80
Winston-Salem, Waterworks Pond.....	500	Sugar Creek.....	120
<b>North Dakota:</b>		Wellington, Waterworks Pond.....	200
Bottineau, Lake Francis.....	400	Woodfield, Little Muskingum River.....	60
Pelican Lake.....	300	Sunfish Creek.....	60
Rude Lake.....	300	Yellow Springs, Neff Park Lake.....	120
Devils Lake, Court Lake.....	250	Youngstown, Bears Den Creek.....	200
Devils Lake.....	750	Big Yankee Creek.....	200
Freshwater Lake.....	250	Indian Creek.....	100
Hettinger, Buckhorn Lake.....	100	Lake Cohasset.....	500
St. John, Crow Lake.....	200	Lake Glacier.....	200
Fish Lake.....	300	Mill Creek.....	200
Garber Lake.....	300	Zanesville, Licking River.....	100
Hill Lake.....	300	Muskingum River.....	100
Loon Lake.....	200	<b>Oklahoma:</b>	
Oak Lake.....	300	Afton, Fuser Lake.....	50
Osland Lake.....	200	Alva, Lake Ashley.....	65
Pelican Lake.....	200	Ardmore, Boucher's pond.....	20
Shutte Lake.....	200	Club Lakes.....	80
Snively Lake.....	300	Dicks Lake.....	40
Sucker Lake.....	300	Sandlin Lake.....	40
Warner Lake.....	200	Wortham Lake.....	40
Waukepa Lake.....	300	Armstrong, Hatchery Ponds.....	70
Willow Lake.....	200	Big Cabin, Mustang Creek.....	40
<b>Ohio:</b>		Rock Creek.....	40
Akron, East Lake.....	500	Bison, Meadowbrook Pond.....	60
Bellaire, Captina Creek.....	50	Blocker, Blue Lake.....	20
Holloway Pond.....	15		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Oklahoma—Continued.		Oklahoma—Continued.	
Broken Bow, Dierks Lake.....	150	Pond Creek, Coldwater Creek.....	120
Yasha Lake.....	150	Crooked Creek.....	120
Byars, Porter-Newbern Lake.....	40	Pond Creek.....	120
Carter, Anderson's pond.....	65	Sand Creek.....	120
Centrahoma, Hall's pond.....	20	Poteau, Horseshoe Lake.....	80
Chattanooga, White's pond.....	40	Purcell, Johnston's pond.....	40
Chickasha, Country Club Lake.....	180	Rocky, Wilburn's pond.....	65
Shawnee Springs Lake.....	60	Sayre, Clear Lake.....	40
Sheds Lake.....	120	Price's pond.....	40
Choteau, Adkins Lake.....	20	Sharon, Persimmon Lake.....	130
Clinton, Clinton Pond.....	65	Shattuck, Ivanhoe Lake.....	325
Coalgate, Jamie Lake.....	40	Texola, Brushy Creek.....	65
Coleman, Owens Lake.....	20	Howard's pond.....	65
Comanche, Lake Eveline.....	40	Speed's pond.....	195
Willow Pond.....	40	Tishomingo, Northside Lake.....	20
Davis, Freeman's pond.....	120	Spring Lake.....	20
Duncan, Doaks Lake.....	40	Tulsa, Sand Springs Park Lake.....	40
Payne's pond.....	80	Vinita, Hawkins's lake.....	40
Durant, Blanchard's pond.....	20	Little Cabin Creek.....	40
El Reno, Redder's pond.....	60	Locust Creek.....	40
Target Creek Lake.....	60	Watts, Illinois River.....	60
Wolf Pond.....	60	Weatherford, Cobb Creek.....	65
Woods Lake.....	60	Pennsylvania:	
Erick, Bull Creek.....	65	Arcola, Perkiomen Creek.....	300
Everett's pond.....	65	Atglen, Glennville Pond.....	400
Haddock's pond.....	65	Bedford, Juniata River, Raystown Branch.....	115
Minnow Creek.....	65	Bryn Mawr, Earle's pond.....	200
Ram Hollow Creek.....	65	Cambridge Springs, Conneaut Lake.....	150
Terrell Lake.....	65	Drakes Pond.....	100
Turkey Creek.....	65	Edinboro Lake.....	300
Eufaula, Eufaula Lake.....	40	Christiana, Johnson Run.....	200
Featherston, Sunnyslope Lake.....	40	Octoraro Creek.....	600
Francis, Oliver Lake.....	40	Collegeville, Perkiomen Creek.....	300
Geary, Senn's pond.....	65	Columbia, Little Chickies Creek.....	300
Granite, Williams's pond.....	40	Confluence, Youghiougheny River.....	140
Guthrie, Cedar Lake.....	48	Conneaut Lake, Conneaut Lake.....	400
Ellison Lake.....	48	Corry, Bear Lake.....	200
Highland Lake.....	48	Brokenstraw Creek.....	200
Lake Corson.....	48	Coffee Creek.....	200
Santa Fe Lake.....	48	Columbus Pond.....	200
Spring Lake.....	48	French Creek.....	200
Williamson Lake.....	48	Denver, Buchers Run.....	100
Heavener, Poteau River.....	60	Leshner Pond.....	200
Poteau River, Black Fork.....	40	Muddy Creek.....	200
Hydro, Southview Pond.....	80	Stony Run.....	200
Kingfisher, Kingfisher Creek.....	120	Dillsburg, Bermudian Creek.....	75
Kiowa, Kiowa Katy Lake.....	60	Eagles Mere, Eagles Mere Lake.....	600
Krebs, Shannon Lake.....	40	East Freedom, Bulls Creek.....	50
Lawton, Highland Lake.....	40	East Greenville, Perkiomen Creek.....	100
Lake Karl.....	80	Easton, Saylors Lake.....	500
Wiedeman Lake.....	80	Ephrata, Hammer Creek.....	200
Lequire, Mountain Fork Creek.....	40	Everett, Juniata River, Raystown Branch.....	500
Lone Wolf, King's pond.....	40	Falls, Susquehanna River, North Branch.....	150
McAlester, Club Lake.....	40	Fishtown, Dunnings Creek.....	225
Dow Lake.....	40	Flowing Spring, Juniata River.....	300
Lake McAlester.....	20	Gaines Junction, Pine Creek.....	50
McAlester's lake.....	20	Ganister, Juniata River, Frankstown Branch.....	300
Twin Buttes Lake.....	20	Gettysburg, Conewago Creek.....	100
Marietta, Club Lake.....	40	Graterford, Perkiomen Creek.....	200
Hotenkamp Lake.....	40	Green Lane, Perkiomen Creek.....	200
Medford, Evans's pond.....	60	Haines, Susquehanna River.....	400
Goldy Pond.....	60	Hendricks, Perkiomen Creek.....	200
Weld Lake.....	60	Holtwood, Tuccuan Lake.....	300
Muldrow, Shepherd's pond.....	20	Horrell, Juniata River.....	300
Muskogee, City Park Lake.....	60	Indian Creek, Indian Creek.....	45
Sondheimer Lake.....	20	Johnstown, Quemahoning Lake.....	400
Vanns Lake.....	40	Kempton, Maiden Creek.....	300
Nowata, Tillotson Lake.....	20	Kratz, Perkiomen Creek.....	200
Ochelata, Scott's pond.....	20	Lancaster, Bushong Pond.....	20
Ottawa, Five Mile Creek.....	20	Conestoga Creek.....	400
Pauls Valley, Adams's pond.....	40	Conestoga Valley Pond.....	20
Democrat Pond.....	40	Hunsecker Pond.....	20
Republican Pond.....	80		
Sherill's pond.....	40		
Training School Pond.....	40		
Perry, City Lake.....	48		
McKinstry Lake.....	48		
New City Lake.....	48		



*Distribution of fish and eggs, fiscal year 1917—Continued.*

LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		South Carolina:	
Lancaster, Mill Creek.....	200	Aiken, Anderson's pond.....	1,000
Paper Mill Pond.....	20	Barton Pond.....	1,500
Susquehanna River.....	500	Busch's pond.....	2,000
Umbles Pond.....	20	Craig's pond.....	500
Waterworks Pond.....	20	Cushman's pond.....	1,500
Langhorne, Neshaminy Creek.....	300	Hendrix Pond.....	2,000
La Plume, Kewanee Pond.....	50	Anderson, Lake Sycamore.....	800
Manataka Pond.....	50	Six and Twenty Pond.....	800
Lewisburg, Buffalo Creek.....	75	Angelus, Rocky Creek Pond.....	1,500
Little Buffalo Creek.....	50	Ashley Junction, Goose Creek.....	1,500
Spruce Run.....	50	Barnwell, Lower Three Runs.....	1,000
Lititz, Lower Hammer Creek.....	200	Batesburg, Boatwright's pond.....	500
Lower Reese, Juniata River.....	300	Belton, Belton Mills Pond.....	750
McLeans, Perkiomen Creek.....	200	Blaney, White Pond.....	2,500
Manheim, Chickies Creek.....	300	Branchville, Smoak's pond.....	450
Manns Choice, Juniata River, Rays- town Branch.....	95	Cameron, Ulmer's pond.....	1,000
Meadville, Cussewago Creek.....	150	Charleston, Goose Creek Pond.....	2,250
French Creek.....	150	Chesterfield, King's pond.....	1,000
Woodcock Creek.....	150	Childs, Gills Creek.....	150
Middleburg, Middle Creek.....	100	Clinton, Wright's pond.....	125
Penns Creek.....	125	Clio, Bennett's pond.....	450
Mill Creek, Saddler Creek.....	150	Clover, Clinton Pond.....	800
Minersville, Crystal Pond.....	75	McCall's pond.....	800
Long Pond.....	50	Columbia, Crane Creek Pond.....	2,100
Mar Lin Lake.....	50	Dent Pond.....	3,500
Nanty Glo, Black Lick Creek.....	50	Huffman's pond.....	2,100
Narvon, Conestoga Creek.....	160	Lowrance's pond.....	800
Neff Station, Juniata River.....	225	Messer Mill Pond.....	3,500
New Oxford, Beaver Creek.....	25	Nims Mill Pond.....	2,800
Conewago Creek.....	50	Snow Hill Pond.....	150
Newtown, Neshaminy Creek.....	700	Darlington, Black Creek.....	300
Oaks, Perkiomen Creek.....	400	Gilvion Mill Pond.....	150
Palm, Perkiomen Creek.....	100	Dorchester, Four Hole Creek.....	4,500
Pennsburg, Perkiomen Creek.....	100	Drayton, Magnolia Garden Lake.....	2,500
Pequea, Pequea Creek.....	300	Edgefield, Mays's pond.....	225
Tucquan Lake.....	300	Embree, Edisto River.....	5,200
Perkiomenville, Perkiomen Creek.....	700	Fairforest, Fairforest Creek Pond.....	100
Petersburg, Hydro Lake.....	50	Fort Motte, Willard Mill Pond.....	1,500
Shaver Creek.....	50	Gaffney, Jolly's pond.....	800
Pocono Summit, Pocono Lake.....	80	Gaston, Guignard's pond.....	150
Point View, Juniata River.....	300	Gilbert, Black Creek.....	1,000
Quarryville, Beaver Creek.....	200	Graniteville, Graniteville Pond.....	900
Conowingo Creek.....	200	Great Falls, Catawba River.....	2,400
Octoraro Creek.....	200	Green Pond, Laurel Lake.....	900
Stewart Creek.....	200	Greenville, Clairmont Lake.....	200
Rahns, Perkiomen Creek.....	200	Dilsy Lake.....	125
Reading, Beaver Creek.....	600	Enoree River.....	200
Red Hill, Perkiomen Creek.....	200	Gilder Creek.....	150
Roaring Springs, Yellow Creek.....	50	Paris Mountain Lake.....	150
Rockmere, Allegheny River.....	500	Saluda River.....	125
Rohrerstown, Conestoga Creek.....	300	Guess, Gullidge Pond.....	1,000
Royersford, Valley Lake.....	100	Hartsville, Black Creek Lake.....	2,500
Rushland, Neshaminy Creek.....	400	Clyde Pond.....	1,500
Salford, Perkiomen Creek.....	200	Johnson Pond.....	1,500
Schwenksville, Perkiomen Creek.....	200	McIntosh Mill Pond.....	1,500
Shenks Ferry, Susquehanna River.....	300	Segar Pond.....	1,500
Shrewsbury, Codorus Creek, West Branch.....	75	Hagood, Rafting Creek Pond.....	1,200
Gunpowder River, branch of.....	75	Hellams Crossing, Reedy River, branch of.....	1,200
Muddy Creek, branch of.....	75	Hickory Grove, Clark Fork Creek.....	2,400
Springboro, Lake Neva.....	200	Ingleside, Ingleside Lake.....	750
Spring Mount, Perkiomen Creek.....	200	Smith Lake.....	600
Stewartstown, Electric Pond.....	50	Iva, Strickland's pond.....	400
Telford, Perkiomen Creek, North- east Branch.....	500	Johnston, Edisto Lake.....	600
Towanda, Susquehanna River.....	100	Watson's pond.....	600
Traymore, Little Neshaminy Creek.....	80	Laurens, Cox Creek.....	125
Warren, Allegheny River.....	300	Lexington, Dooly-Shull Pond.....	1,500
Conowango Creek.....	300	Twelve Mile Creek.....	150
Williamsburg, Juniata River.....	300	Mayo, Buck Creek.....	1,200
Williamsport, Loyalsock Creek.....	75	Mount Croghan, Burch's pond.....	1,500
Lycoming Creek.....	75	Ingleside Pond.....	500
Yerkes, Perkiomen Creek.....	300	Ninety Six, Meadow Branch.....	1,600
York, Codorus Creek.....	100	Orangeburg, Brantley's pond.....	1,700
Conewago Creek.....	100	Edisto River.....	5,000
Zeiglersville, Perkiomen Creek.....	200	Felder's pond.....	200
		Fersner's pond.....	25
		Fogle's pond.....	200

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
South Carolina—Continued.		Tennessee—Continued.	
Orangeburg, Great Branch Pond.....	48	McMinnville, Mountain Creek.....	50
Limestone Creek.....	600	Manchester, Brewer Creek.....	1,500
Orchard Park Pond.....	900	Duck River.....	1,500
Smoak's pond.....	1,000	Martell, Morton's pond.....	20
Ulmer's pond.....	1,200	Martin, Harris Fork Creek.....	†4,000
Woodville Pond.....	50	Mud Creek.....	†4,000
Patrick, Bear Creek Pond.....	1,500	North Obion River.....	†13,000
Toibert's pond.....	1,000	Mayland, Cooper Lake.....	150
Raylin, Gantt's pond.....	150	Memphis, Arnold Lake.....	70
Ridge Spring, Yonce's pond.....	300	Mont Eagle, Laurel Lake.....	40
Rockton, Castles's pond.....	400	Murphreesboro, Stone River.....	1,000
Ruby, Moore's pond.....	500	Nashville, Brons Creek, Sugar Tree	
St. Matthews, Millwood Pond.....	325	Branch.....	118
Salley, Cooper's pond.....	1,000	Cumberland River.....	48
Seneca, Cane Creek.....	500	Lake Clara.....	1,000
Coneross Creek.....	300	Radnor Lake.....	4,000
Keowee River.....	300	Norma, New River.....	†1,000
Little River.....	300	Oliver Springs, East Fork Creek.....	75
Martins Creek.....	450	Poplar Creek.....	75
Seneca River.....	300	Ooltewah, Wolf Teaver Creek.....	150
Snow Creek.....	400	Portland, Sinkhole Pond.....	25
Sugar Creek.....	300	Powder Springs, Flat Creek.....	125
Sharp, Tompkins's pond.....	400	Pulaski, Richland Creek.....	48
Summerton, Pine Grove Pond.....	300	Quebeck, Pettitt's pond.....	75
Summersville, Engleside Lake.....	2,500	Roan Mountain, Doe River.....	†500
Timber Lake, Edisto River.....	3,500	Rockwood, Johnson's pond.....	†500
Trenton, Lorick Pond.....	450	Whites Creek.....	†500
Warren Pond.....	300	St. Bethlehem, Bourne Lake.....	140
Wagener, Cedar Creek Pond.....	1,500	Shelbyville, Duck River.....	1,250
York, Lanham Pond.....	1,200	Springfield, Holman Pond.....	1,000
South Dakota:		Luton's pond.....	500
Alpena, Lake Overland.....	200	Red River, Sulphur Fork.....	1,548
Canton, Sioux River.....	530	Red River, West Fork.....	150
Clear Lake, Clear Lake.....	500	Tazewell, Chadwell Lake.....	20
Eureka, Lake Martell.....	450	Tellico Plains, Conasauga Creek.....	†4,000
Hot Springs, Palmer Lake.....	70	Toone, Keller Lake.....	80
Huron, Lake Byron.....	175	Wartrace, Wartrace Creek.....	1,500
Lake Cavour.....	105	Watertown, Fall Creek.....	150
Lake Andes, Lake Andes.....	280	Waverly, Buffalo River.....	2,000
Lemmon, Lemmon Lake.....	300	Wetmore, Prendergast Lake.....	40
McCook, McCook Lake.....	400	White Pine, Long Creek.....	†500
Madison, Lake Madison.....	280	Winchester, Elk River.....	50
Midland, Hedman Lake.....	70	Willow Pond.....	1,000
Pukwana, Red Lake.....	280	Texas:	
Rapid City, Spruce Pond.....	70	Alvarado, Lake View.....	180
Virgil, Barnes's pond.....	200	Axtell, Axtell Lake.....	1,850
Tennessee:		Everman Lake.....	1,900
Austral, Spring Creek.....	†2,000	Belen, Young's pond.....	75
Bear Creek Junction, Mining Com-		Bryan, Lakeview Pond.....	200
pany Ponds.....	60	Round Lake.....	175
Bolivar, Galloway's pond.....	80	Caldwell, Volney Lake.....	200
Chapel Hill, Townsend Pond.....	1,000	Wilson Lake.....	800
Chattanooga, Lookout Lake.....	125	Center Point, Guadalupe River.....	1,400
Pan-Gap Lake.....	†4,000	Clear Fork, Clear Fork Lake.....	300
Round Lake.....	125	Cleburn, Club Lake.....	420
Cleveland, Wildwood Lakes.....	404	Corsicana, Beeman Pasture Pond.....	800
Coal Creek, Coal Creek.....	†500	Magnolia Ponds.....	4,800
College Grove, College Grove Creek.....	40	Morse Pond.....	800
Cragie Hope, Turnbull Creek.....	1,500	Orphans Home Pond.....	1,600
Elkmont, Little River, East		Texas Company Pond.....	1,600
Prong.....	60	Dallas, Harris Lake.....	300
Fayetteville, Elk River.....	50	Larkin's pond.....	500
Mulberry Creek.....	1,500	Wah Hoo Club Lake.....	900
Fordtown, Sinking Creek.....	†500	Denison, Randall Lake.....	1,500
Franklin, Big Harpeth River.....	2,547	Edmunds, Guy Lake.....	400
Leipers Fork Creek.....	1,047	Fort Worth, Alta Vista Lake.....	1,250
Murphy Fork Creek.....	24	Bear Creek Lake.....	250
Ridley's pond.....	500	Howser Lake.....	250
South Harpeth River.....	47	Lake Worth.....	1,250
West Harpeth River.....	47	Franklin, Lake Bernadine.....	600
Goodlettsville, Connell's pond.....	1,000	Lake Meldune.....	500
Greenfield, Elam's pond.....	500	Lake Mirage.....	575
Hoods, Little River.....	†1,000	Georgetown, Ganns Mills Lake.....	2,000
Howell, Cane Creek.....	1,500	Grand Prairie, Martin Lake.....	250
Jacksboro, Town Creek.....	75	Robbins's pond.....	250
Jackson, Love's pond.....	†2,000	Grandview, Country Club Lake.....	720
Knoxville, Beaver Creek.....	†1,000	Granger, Parmalee Lake.....	3,000
McEwen, Hurricane Creek.....	100		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Texas—Continued.		Virginia—Continued.	
Greenville, Arnold's pond.....	500	East Radford, New River.....	60
Chapman's pond.....	500	Elliston, Roanoke River.....	90
Greenville Pond.....	1,500	Emporia, Three Creeks Pond.....	{ 13,000
Handley, Edrington Lake.....	200	Faber, Gay's pond.....	450
Houston, Cross Ranch Lake.....	800	Farmville, Curdsville Mill Pond.....	60
Pumpkin Lake.....	1,200	Fort Defiance, Middle River.....	45
Round Lake.....	640	Fredericksburg, Downman's pond.....	30
Wayside Lakes.....	316	Falls Mills Pond.....	50
Hubbard, Club Lakes.....	3,365	Hick's pond.....	300
Waterworks Lakes.....	2,865	Little Whim Pond.....	30
Kerrville, Guadalupe River.....	1,400	Miller's pond.....	400
Paint Pond.....	700	Gala, James River.....	45
Palmer Pond.....	700	Glen Allen, Chickahominy Pond.....	300
Reagan Pond.....	1,400	Chickahominy River.....	400
Terrell Lake.....	700	Clifton Pond.....	150
Kyle, Pecan Pond.....	200	Gordonville, Noble's pond.....	15
Lancaster, Club Lake.....	375	Rae's pond.....	300
Grimes's pond.....	300	Watkin's pond.....	400
Manchuca, Golden Lake.....	400	Goshen, Big Calf Pasture River.....	45
New Braunfels, Comal River.....	4,300	Green Bay, Blankenship Mill Pond.....	75
Guadalupe River.....	1,580	Greenlee, James River.....	45
Simmons Creek.....	1,400	Guinea, Mill Hill Pond.....	25
Spring Branch.....	1,400	Hanover, Mitchell's mill pond.....	900
Palestine, Blue Lake.....	1,200	Mount Pleasant Pond.....	400
Broyles Lake.....	700	Herndon, Wiehle Lake.....	50
Phillips Lake.....	700	Holcomb Rock, James River.....	45
San Antonio, Blue Wing Lake.....	2,800	Ivanhoe, Chestnut Creek.....	30
San Marcos, San Marcos River.....	5,000	Cripple Creek.....	30
Texarkana, Davis Lake.....	700	Poplar Camp Creek.....	30
Kings Lake.....	4,200	Kernstown, Opequon Creek.....	15
T. S. & N. Lake.....	700	Keswick, Bellagio Pond.....	1,350
Thorndale, Gregory's pond.....	200	Keysville, Morton's pond.....	30
Johnson's pond.....	200	Lightfoot, Jollys Club Pond.....	15
Uvalde, Anderson Lake.....	250	Happy Dell Pond.....	45
Frio River.....	775	Louisa, Bucks Pond.....	15
Leona River.....	1,580	Lynchburg, Campbell's pond.....	30
Nueces River.....	3,195	James River.....	240
Two Mile Lake.....	595	Rockfish River.....	90
Waco, Club Lake.....	1,000	Max Meadows, Reed Creek.....	150
Elm Lake.....	1,000	Midlothian, Grove Shaft Pond.....	100
Fort Lake.....	1,200	Milford, Andrews Pond.....	400
Hickory Creek.....	1,200	Chandler's pond.....	100
Maupin Lake.....	1,200	Norge, Scimiron Pond.....	300
Spring Lake.....	1,200	Whitaker Mill Pond.....	300
Waring, Guadalupe River.....	1,400	Pemberton, Flannagan's mill pond.....	60
Welfare, Joshua Creek.....	1,400	Whiteville Pond.....	30
Vermont:		Penola, Camp Pond.....	25
Essex Junction, Shelburne Pond.....	120	Campbell's pond.....	25
Hydeville, Lake Bomoseen.....	375	Hickory Spring Pond.....	400
Virginia:		Reedy Mill Pond.....	300
Alberta, Sturgeon Creek Pond.....	300	Turner's pond.....	25
Alleghany, Dunlap Creek.....	30	Petersburg, Lees Mill Pond.....	1,200
Ashland, Lucky Strike Pond.....	400	Providence Forge, Mallory's pond.....	800
Luck's pond.....	300	Mirror Lake.....	15
Beaver Dam, Beaver Dam Lake.....	1,350	Providence Pond.....	15
Thompson's pond.....	450	Randolph, Spring Lake.....	30
Bedford, Big Otter Creek.....	1,050	Rectortown, Goose Creek.....	15
Silver Lake.....	700	Reusens, James River.....	60
Blackstone, Cellar Creek Pond.....	600	Richmond, Broad Rock Pond.....	15
Brookneal, Clay's pond.....	400	City Lake.....	30
Falling Creek.....	400	Clarendon Lake.....	600
Turnip Creek.....	300	Coleman Pond.....	15
Buchanan, James River.....	60	Ellerson's pond.....	30
Mill Creek.....	60	Forest Park Lake.....	400
Byllesby, Crooked Creek.....	30	Lakeside Lake.....	1,015
Knob Fork Creek.....	30	Red Lake.....	400
New River.....	30	Sledd Mill Pond.....	30
Carterton, Clinch River.....	100	Tiller's pond.....	100
Cave Station, North River.....	45	Watkins Mill Pond.....	400
Charlottesville, Maury's pond.....	15	Ringgold, Power's pond.....	400
Ravanna River, North Fork.....	15	Rocky Mount, Fryng Pan Creek.....	30
Christiansburg, Poff Branch.....	1,050	Pig River.....	30
Church Road, Williams Pond.....	30	Roxbury, Captain Joes Pond.....	315
Courtland, Edward's pond.....	1,000	Charles City Pond.....	400
Gray's pond.....	400	Parkinson's pond.....	300
Danville, County Line Creek.....	600	St. Paul, Clinch River.....	200
Dispatch, Orapax Pond.....	15	Saltville, Holston River, North	
Drakes Branch, Roanoke River.....	60	Branch.....	45
Eagle Mountain, James River.....	45		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Virginia—Continued.		Wisconsin—Continued.	
Singer, Roanoke River.....	1,050	Centuria, Little Balsam Lake.....	300
South Norfolk, Greenleaf Pond.....	400	Long Lake.....	300
Stephens City, Cedar Creek.....	15	Loveless Lake.....	200
Shenandoah River.....	15	Crandon, Sand Lake.....	300
Suffolk, Lake Drummond.....	800	Deer Park, Bear Trap Lake.....	300
Suiter, Walkers Big Creek.....	45	Fish Lake.....	300
Swords Creek, Clinch River, Maiden		Long Lake.....	300
Spring Fork.....	330	Donaldson, Clara Lake.....	200
Sycamore, Owen Hunt Pond.....	30	Island Lake.....	200
Taylorville, Dry Bridge Pond.....	200	Lost Lake.....	200
Tazewell, Clinch River, West Fork.....	265	Moccasin Lake.....	200
Wolf Creek.....	450	Eagle River, Eagle Chain of Lakes.....	7,000
Toano, White Hall Pond.....	15	Elcho, Otter Lake.....	300
Waverly, Clark Pond.....	600	Rifield, McArthur Lake.....	300
Wellville, Booth Pond.....	600	Round Lake.....	200
West Point, Goddin Pond.....	15	Fond du Lac, Lake de Nevue.....	300
Holly Fork Pond.....	15	Twin Lake.....	300
Old Dominion Lake.....	15	Mountain City, Mississippi River.....	a 13,900
White House, Poplar Grove Pond.....	15	Galesville, Beaver Creek.....	300
Williamsburg, Warburton's pond.....	300	Genoa, Mississippi River.....	a 500
Woodstock, Power Company Pond.....	15	Grand Rapids, Wisconsin River.....	1,950
Rush Pond.....	15	Hartford, Mud Lake.....	400
Stonewall Pond.....	15	Hayward, Amidon Lake.....	300
West Virginia:		Bass Lake.....	200
Belington, Hawley Lake.....	100	Bursinger Lake.....	200
Bramwell, Bluestone River.....	450	Chief River, North Fork.....	50
Simmons Lake.....	150	Couderay River.....	200
Camden on Gauley, Middledy Creek.....	200	Crystal Lake.....	200
Clarksburg, West Fork River.....	300	Deer Lake.....	200
Clay, Buffalo Creek.....	100	Dunn Lake.....	150
Cotton Hill, New River.....	700	Grafton Lake.....	200
Cowen, Gauley River.....	200	Grindstone Lake.....	200
Harrisville, Hughes River.....	100	Gurno Lake.....	300
Huntington, Twelve Pole Creek.....	600	Horseshoe Lake.....	100
Keyser, Cabin Run.....	100	Lake Tobactic.....	100
New Creek.....	100	Long Lake.....	150
Patterson Creek.....	125	McConnell Lake.....	200
Logan, Guyandotte River.....	300	Martin Lake.....	100
Mannington, Buffalo Creek.....	100	Phaquaawong Lake.....	200
Martinsburg, Opequon Creek.....	150	Phipps Pond.....	50
Potomac River.....	200	Potato Lake.....	200
New Martinsville, Fishing Creek.....	300	Red Ike Lake.....	300
Oral, Oral Lake.....	700	Tobactic River.....	200
Paw Paw, Cacapon River.....	150	Tyner Lake.....	200
Petersburg, Potomac River, South		Whitten Lake.....	300
Branch.....	450	Hazelhurst, Lake Katherine.....	400
Romney, Potomac River, South		Lake Kaubashien.....	400
Branch.....	300	Lake Seventeen.....	400
Wisconsin:		Independence, Elk Lake.....	500
Bangor, Cedar Lake.....	300	Iron Mountain, Spread Eagle Lake.....	300
Jenkins Pond.....	100	Killbourn, Wisconsin River.....	400
Ruland Pond.....	200	La Crosse, Mississippi River.....	a 4,300
Baraboo, Dell Creek.....	100	Ladysmith, Hemlock Lake.....	300
Devils Lake.....	600	Kegama Lake.....	300
Fern Dell Lake.....	300	Lake Beulah, Lake Beulah.....	400
Mirror Lake.....	200	Lake Delavan, Lake Delavan.....	500
Pickarel Slough Pond.....	200	Lynxville, Mississippi River.....	a 500
South Bay.....	300	Manitowoc, English Lake.....	200
Tims Pond.....	300	Harps Lake.....	200
Twin Slough Pond.....	200	Hartlaub Lake.....	200
Barneveld, Ball Creek.....	150	Hampton Lake.....	200
Biramwood, Bass Lake.....	200	Schissell Lake.....	200
Mayflower Lake.....	200	Silver Lake.....	200
Tood Lake.....	200	Mattoon, Baker Lake.....	300
Black River Falls, Morrison Creek,		Mayville, Rock River.....	200
South Fork.....	400	Mazomonie, Lake Marion.....	800
Brokaw, Silver Creek.....	300	Mill Pond.....	1,200
Butternut, Bass Lake.....	300	Medford, Kohns Lake.....	300
Cable, Bass Lake.....	300	Lake Thirty Two.....	300
Henry Lake.....	300	Otter Lake.....	300
Rosy Lake.....	300	Twin Lakes.....	300
Twin Lakes.....	300	Mellen, Chub Lake.....	400
Cedarburg, Cedar Creek.....	300	Le Land Lake.....	300
Centuria, Bass Lake.....	300	Little Lake.....	300
Deer Lake.....	300	McCarthy Lake.....	300
Half Moon Lake.....	300	Meeder Lake.....	300

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## LARGEMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Mellen, Moquak Lake.....	300	Sparta, La Crosse River.....	100
Penokee Lake.....	300	Leon Mill Pond.....	200
Potter Lake.....	300	Lower La Crosse River.....	400
Menomonie, Caryville Lake.....	100	McCoy Pond.....	100
Cedar Lake.....	100	Mill Pond.....	200
Doyles Lake.....	100	Newton Pond, Lower.....	200
Eighteen Mile Lake.....	100	Newton Pond, Upper.....	200
Goose Lake.....	100	Paper Mill Pond.....	200
Hay River.....	100	Perch Lake.....	200
Lake Menomonie.....	100	Shoemaker Pond.....	200
Manbeek Lake.....	100	Star Lake, Ballard Lake.....	400
Miller Lake.....	100	Stone Lake, Grindstone Lake.....	400
Moore Farm Lake.....	100	Runzel Lake.....	300
Mud Lake.....	100	Three Lakes, Butternut Lake.....	100
Pitt Lake.....	100	Cook Lake.....	100
Red Cedar River.....	100	Crooked Lake.....	100
Rowe Lake.....	100	Four Mile Lake.....	100
Stump Lake.....	100	Frog Lake.....	100
Wilson Lake.....	100	Little Moccasin Lake.....	100
Nashville, Dry Lake.....	300	Maple Lake.....	100
Norrie, Lake Gotoit.....	300	One Stone Lake.....	100
Mayflower Lake.....	300	Planting Ground Lake.....	100
Mud Lake.....	200	Range Line Lake.....	100
Park Falls, Big Bass Lake.....	200	Rice Lake.....	100
Butternut Lake.....	200	Round Lake.....	100
Little Bass Lake.....	200	Thunder Lake.....	100
Oxbow Lake.....	200	Town Line Lake.....	100
Pelican Lake.....	200	Tomahawk, Crystal Lake.....	200
Pike Lake.....	200	Deer Lake.....	200
Snow Lake.....	200	Lake Clara.....	200
Pembine, Belgium Lake.....	300	Mirror Lake.....	200
Lindquist Lake.....	300	Rice River.....	200
Phelps, Big Bass Lake.....	200	Somo River.....	200
North Twin Lake.....	200	Spirit River.....	200
Portage, Lake Swenson.....	300	Tomahawk River.....	200
Lake Wisconsin.....	500	Wisconsin River.....	200
Poynette, Mackenzie Mill Pond.....	200	Tomahawk Lake, Wind Pudding Lake.....	300
Prairie du Sac, Baraboo River.....	350	Trempealeau, Chain of Lakes.....	300
Readstown, Cutoff Creek.....	225	Mississippi River.....	a 2,385
Deadwater Pond.....	150	Round Lake.....	300
Kickapoo River, Horseshoe Bend Branch.....	375	Union Grove, Eagle Lake.....	300
Kickapoo River, West Branch.....	375	Waupaca, Rainbow Lake.....	300
Reedsburg, Baraboo River.....	300	Wausau, Rib River.....	900
Rice Lake, Bear Lake.....	200	Winter, Bass Lake.....	300
Cedar Lake.....	200	Black Dan Lake.....	300
Deitz Lake.....	200	Wonewoc, Baraboo River.....	200
Devils Lake.....	200	Mill Pond.....	200
Ginder Lake.....	200	Peters Bay.....	200
Hemlock Lake.....	200	Rodgers Pond.....	200
Long Lake.....	200	Sand Pond.....	200
Shawano, Shawano Creek.....	100	Wolfenden Pond.....	200
Sheboygan, Goetzer Lake.....	300	Wycocna, Lake George.....	200
Sheboygan Falls, Cedar Lake.....	300	Mill Pond.....	200
Gerber Lake.....	300	Wyoming:	
Getzger Lake.....	300	Cheyenne, Lake Minnehaha.....	285
Pigeon Lake.....	300	Pearsons Lake.....	570
Somerset, Apple River.....	125	Sloans Lake.....	285
Bass Lake.....	200	Canal Zone: Ancon, Panama Canal.....	450
Sparta, Angelo Pond.....	300		
Bacon Pond.....	100		
Depot Pond.....	200		
Ginsline Pond.....	200		
		Total b.....	{ 1320,050 961,912

## SMALLMOUTH BLACK BASS.

Arkansas:		Colorado: Palmer Lake, Palmer Lake.....	200
Batesville, Spring Creek.....	90	Connecticut:	
DeQueen, Big Bear Creek.....	60	Greenwich, Peequo Lake.....	287
Elba, Little Red River.....	400	Plantsville, Plants Pond.....	100
Fayetteville, Clear Creek.....	80	Watertown, Long Meadow Lake.....	120
Mammoth Spring, Myatt Creek.....	100	Delaware:	
Spring River.....	100	Lincoln City, Reynolds Pond.....	500
St. Francis Station, St. Francis River.....	220	Wilmington, Bellevue Pond.....	500
		Circle Pond.....	40

a Rescued from overflowed lands and restored to original waters.

b Lost in transit, 2,551 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SMALLMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Indiana:</b>		<b>Michigan—Continued.</b>	
Edinburg, Sugar Creek.....	1,200	Holly, Simonson Lake.....	†2,000
Greensburg, Big Four Lake.....	400	Jackson, Browns Lake.....	†2,000
New Albany, Silver Creek.....	1,000	Gillett Lake.....	†2,000
Shelbyville, Flat Rock River.....	400	Vandercook Lake.....	300
Iowa: Delaware, Volga River.....	†3,000	Kalamazoo, Crooked Lake.....	300
<b>Kentucky:</b>		Lakeland, Huron River.....	†4,000
Cadiz, Little River, Sinking Fork.....	1,400	Lapeer, Lake Neppissing.....	†2,000
Madisonville, Spring Lake.....	300	La Roche, Lake Ella.....	†2,000
Munfordville, Green River.....	800	Lake Nettie.....	†2,000
Louisiana: Natchitoches, Cane River.....	300	Manitou Beach, Devils Lake.....	600
<b>Maine:</b>		Middleville, Thornapple River.....	†2,000
Machias, Hadley Lake.....	400	Milford, Round Lake.....	500
Oakland, Little Pond.....	600	Oscoda, Van Etten Lake.....	†4,000
Princeton, Big Lake.....	400	Owosso, Maple River.....	†2,000
Lewey Lake.....	500	Palmyra, Raisin River.....	250
Long Lake.....	400	Pentwater, Bass Lake.....	†2,000
Readfield, Echo Lake.....	400	Pontiac, Ox Bow Lake.....	†2,000
<b>Maryland:</b>		Richland, Miller Lake.....	†2,000
Dickerson, Potomac River.....	a 100	Romeo, Cusick Lake.....	†2,000
Frostburg, Potomac River.....	120	Rose Center, Hunniston Lake.....	†1,000
Hagerstown, Antietam Creek.....	†12,000	St. Louis, Pine River.....	125
Conococheague Creek.....	†12,000	St. Louis Pond.....	†4,000
Potomac River.....	†6,000	South Branch, Lake Mio.....	†4,000
Selbyport, Youghiogheny River.....	120	Red Head Lake.....	†1,000
Seneca, Potomac River.....	a 220	Springport, Duck Lake.....	†2,000
<b>Massachusetts:</b>		Walled Lake, Walled Lake.....	†4,000
Almont, Ames Lake.....	200	White Cloud, Crystal Lake.....	†2,000
Meadow Lake.....	1,500	Mast Pond.....	†1,000
Boxford, Stevens Pond.....	†1,500	<b>Minnesota:</b>	
Lowell, Flushing Pond.....	†1,500	Deerwood, Bay Lake.....	600
Hart Pond.....	†1,500	Duluth, Lake Antoinette.....	300
Tyngs Pond.....	†1,500	Knife River, Crooked Lake.....	100
New Bedford, Long Pond.....	400	Litchfield, Dunn Lake.....	300
Mary Pond.....	300	Lake Minnebelle.....	300
Mattapoisett River.....	300	Lake Ripley.....	300
Snows Pond.....	300	Lake Stella.....	300
Pepperell, Massapoag Lake.....	235	Lake Washington.....	300
Pittsfield, Onota Lake.....	350	Richardson Lake.....	300
Pontoosuc Lake.....	480	White Bear, White Bear Lake.....	300
Webster, Baker Pond.....	250	<b>Missouri:</b>	
Carbuncle Pond.....	250	Arlington, Big Piney River.....	400
Chaubunagungamaug Lake.....	300	Aurora, Flat Creek.....	†600
Haven Pond.....	250	Cabool, Hog Creek.....	200
Peter Pond.....	250	Kansas City, Alton Slater Pond.....	57
<b>Michigan:</b>		Lamar, Spring River, Muddy Branch.....	146
Alpena, Devil Lake.....	†2,000	Mansfield, Bryant River.....	500
Grand Lake.....	†2,000	Merwin, Corbin's pond.....	200
Hubbard Lake.....	†2,000	<b>New Hampshire:</b>	
Athens, Clater Lake.....	†2,000	Antrim, Gregg Lake.....	500
Kenyon Lake.....	†2,000	Chesham, Silver Lake.....	400
Lehr Lake.....	†2,000	Concord, Contoocook River.....	200
Belding, Robsis Lake.....	300	Plymouth, Loon Lake.....	300
Blissfield, Raisin River.....	250	<b>New Jersey:</b>	
Brighton, Baeteka Lake.....	†2,000	Boonton, Consolidated Lake.....	100
Charlotte, Narrow Lake.....	†2,000	Rock Peon Lake.....	100
Cheboygan, Twin Lakes.....	†4,000	Camden, Willow Grove Lake.....	500
Clarion, Walloon Lake.....	†5,000	Dover, Picatinny Lake.....	100
Concord, Swains Lake.....	300	Shongum Lake.....	3,500
Dowagiac, Indian Lake.....	300	Hackettstown, Allamuchy Lake.....	100
East Tawas, Indian Lake.....	†4,000	Croton Lake.....	100
Elba, Riley Lake.....	†1,000	Guard Lock Pond.....	100
Grand Rapids, Lappin Lake.....	†2,000	Hatchery Ponds.....	1,500
Highland, Alderman Lake.....	†2,000	Newburg Pond.....	100
Bitten Lake.....	†2,000	Lake Grennell, Lake Grennell.....	500
Cundy Lake.....	†2,000	Morris Plains, Hospital Ponds.....	1,000
Downey Lake.....	†2,000	Patterson, Passaic River.....	125
Duck Lake.....	†2,000	Plainfield, Robinson Lake.....	1,400
Dunham Lake.....	†2,000	Princeton Junction, Carnegie Lake.....	200
Harvey Lake.....	†2,000	Saddle River, Connolly's pond.....	70
Long Lake.....	†2,000	<b>New York:</b>	
Maxfield Lake.....	†2,000	Addison, Canisteo River.....	322
Mud Lake.....	†2,000	Amsterdam, Schoharie River.....	70
Round Lake.....	†2,000	Batavia, Godfrey Pond.....	400
Whalen Lake.....	†2,000	Horseshoe Lake.....	300
Hillman, Brush Lake.....	†2,000	Binghamton, Chenango River.....	192
Round Lake.....	†2,000	Susquehanna River.....	183
Hillsdale, Baw-Beese Lake.....	250	Cazenovia, Cazenovia Lake.....	200
		Clemons, Long Pond.....	70

a Rescued from Chesapeake &amp; Ohio Canal and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SMALLMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
New York—Continued.		Pennsylvania—Continued.	
Cohoes, Mohawk River.....	150	Biglerville, Conewago Creek.....	400
Collins, Hospital Pond.....	102	Bushkill, Deer Lake.....	150
Corning, Cauleteo River.....	200	Delaware River.....	354
Chemung River.....	200	Forest Lake.....	200
Cohocton River.....	200	Lake Taminet.....	200
Fonda, Middle Lake.....	50	Butler, Glade Run.....	600
West Caroga Lake.....	50	Little Creek.....	1,200
West Stink Lake.....	50	Rough Run.....	1,200
Glen Flora, Glen Lake.....	100	Thorn Creek.....	1,200
Gloversville, Canada Lake.....	70	Chadds Ford, Patterson Pond.....	60
Hamilton, Lebanon Pond.....	200	Cochranon, French Creek.....	200
Woodman Pond.....	200	Collegeville, Perkiomen Creek.....	250
Harpursville, Susquehanna River.....	200	Skippack Creek.....	500
Lake Bonaparte, Lake Bonaparte.....	183	Confluence, Youghiogheny River.....	400
La Salle, Niagara River, Upper.....	300	Conneaut Lake, Conneaut Lake.....	700
Le Roy, Oatka Creek.....	300	Connellsville, Youghiogheny River.....	200
Monsey, Saddle River.....	105	Dalmatia, East Mahantonga Creek.....	61
Moravia, Owasco Lake.....	204	Susquehanna River.....	122
Newark, Canarqua Creek.....	200	Doylestown, Neshaminy Creek.....	1,200
Niagara Falls, Niagara River.....	180	Tohickon Creek.....	1,000
Norwich, Bracketts Lake.....	200	East Greenville, Perkiomen Creek.....	250
Chenango Lake.....	200	Skippack Creek.....	250
Chenango River.....	200	Easton, Delaware River.....	620
McDonough Lake.....	200	Ellwood City, Connoquenessing River.....	150
Meads Pond.....	200	Factoryville, Lake Sheridan.....	750
Palmyra, Barge Canal.....	60	Falls, Lake Wynola.....	160
Campbell Pond.....	60	Franklin, Lake Emma.....	100
Mud Creek.....	60	Sugar Creek.....	200
Red Creek.....	60	Frazer, Ridley Pond.....	500
Port Henry, Lake Champlain.....	150	Freedom, Brush Creek.....	61
Lake Wawonaissa.....	150	Gettysburg, Big Marsh Creek.....	2,000
Rome, Bullhead Lake.....	61	Graterford, Perkiomen Creek.....	250
Schenectady, Mariaville Pond.....	85	Skippack Creek.....	500
Syracuse, Cazenovia Lake.....	120	Green Lane, East Swamp Creek.....	250
Cross Lake.....	580	Skippack Creek.....	250
Jamesville Pond.....	320	Hendricks, Perkiomen Creek.....	250
Otisco Lake.....	580	Skippack Creek.....	250
Skaneateles Lake.....	380	Jersey Shore, Pine Creek.....	122
Truxton, Tioughniough River, East Branch.....	200	Keisters, Slippery Rock Creek.....	80
Utica, Risley Pond.....	100	Kratz, Perkiomen Creek.....	250
North Carolina:		Skippack Creek.....	250
Altapass, Emanuel's pond.....	†500	Lake Carey, Lake Carey.....	204
Brevard, French Broad River.....	†500	La Plume, Keewanee Pond.....	102
Lake Elvira.....	†500	Manataka Pond.....	102
Pickleseimer Pond.....	†500	Lebanon, Ebenezer Pond.....	300
Sapphire Lake.....	†500	Grohs Pond.....	250
Burlington, Glencoe Pond.....	†500	Little Swatara Creek.....	500
Haw River Pond.....	†500	Lewisburg, Buffalo Creek.....	250
Piedmont Lake.....	250	Lititz, Conestoga Creek.....	750
Piedmont South Lake.....	250	McLeans, Perkiomen Creek.....	250
Scott Lake.....	†500	Skippack Creek.....	250
Connelly Springs, Alexander's pond.....	75	Meadville, Cussewago Creek.....	200
Ela, Soco Creek.....	†500	French Creek.....	200
Four Oaks, Keens Pond.....	75	Woodcock Creek.....	200
Hendersonville, Lake Wajaw.....	†500	New Castle, Neshannock Creek.....	1,400
Hot Springs, Shulin Creek.....	75	Newport, Cocolamas Creek.....	250
Spring Creek.....	75	Juniata River.....	1,250
Lake Toxaway, Lake Toxaway.....	†1,000	New Ringold, Rausch Lake.....	408
Lumberton, McAlester's pond.....	150	Oaks, Perkiomen Creek.....	250
North Wilkesboro, Buffalo Creek.....	†1,000	Skippack Creek.....	500
Elk Creek.....	†1,000	Orwigsburg, Raushes Pond.....	500
Yadkin River, Lewis Fork.....	†500	Palm, Perkiomen Creek.....	125
Yadkin River, Stony Fork.....	†500	Skippack Creek.....	125
Princeton, Holt's pond.....	250	Parkers Glen, Twin Lakes.....	200
Raleigh, Milburnie Pond.....	†500	Pennsburg, Perkiomen Creek.....	250
Myatt Pond.....	250	Skippack Creek.....	250
Ohio:		Perkiomenville, Perkiomen Creek.....	250
Mentor, Morley Lake.....	300	Skippack Creek.....	250
Steubenville, Cross Creek.....	575	Phoenixville, French Creek.....	250
Yellow Creek.....	575	Perkiomen Creek.....	250
Pennsylvania:		Pickering Creek.....	250
Arcola, Perkiomen Creek.....	250	Stony Run.....	250
Skippack Creek.....	500	Pittston, Worden Creek Lake.....	500
Ariel, Lake Lacawac.....	200	Pocono Summit, Tobyhanna Creek.....	500
Atglen, Octoraro Creek.....	180	Tunkhannock Creek.....	75
Beech Creek, Bald Eagle Creek.....	183	Quakertown, Stover Pond.....	400
Beech Creek.....	61	Rahns, Perkiomen Creek.....	250
Benton, Susquehanna River.....	60	Skippack Creek.....	500

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SMALLMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Pennsylvania—Continued.		West Virginia:	
Reading, Alleghany Creek.....	36	Berkeley Springs, Sleepy Creek.....	240
Angelico Creek.....	36	Capon Springs, Great Cacapon River.....	†10,000
Bernhart Creek.....	40	Charleston, Elk River.....	†8,000
Cacoosing Creek.....	36	Groves, Groves Creek.....	500
Irish Creek.....	72	Huntington, Guyandotte River.....	1,110
Manatawny Creek.....	36	Twelve Pole Creek.....	925
Monocacy Creek.....	36	Marne, Elk River.....	1,000
Ontelaunee Creek.....	36	Petersburg, Potomac River, South Fork.....	2,400
Socany Creek.....	36	Porter, Elk River.....	†3,000
Wyomissing Creek.....	536	Raleigh, Piney River.....	†5,000
Red Hill, East Swamp Creek.....	250	Shelton, Elk River.....	†6,000
Skippack Creek.....	250	Wellsburg, Buffalo Creek.....	2,600
Royersford, French Creek.....	500	Wisconsin:	
Kimberton Pond.....	250	Amery, Lost Lake.....	300
Salford, Perkiomen Creek.....	250	Round Lake.....	300
Skippack Creek.....	250	Ashland, Bass Lake.....	300
Schwenksville, Perkiomen Creek.....	250	Basswood Lake.....	300
Skippack Creek.....	500	Buck Hill Lake.....	400
Sellersville, Perkiomen Creek, Northeast Branch.....	800	Clear Lake.....	400
Sewickley, Big Traverse Creek.....	61	Crystal Lake.....	400
Raccoon Creek.....	200	Duck Lake.....	300
Sharpsville, Shenango River.....	280	Dupont Lake.....	400
Shaws, French Creek.....	208	Everett Lake.....	300
Shenks Ferry, Susquehanna River.....	250	Ewen Lake.....	400
Ship Road, Forty Acre Pond.....	250	Finger Lake.....	400
Ship Road Pond.....	250	Fish Lake.....	300
Spring Mount, Perkiomen Creek.....	250	Lamal Lake.....	300
Skippack Creek.....	250	Long Lake.....	400
Stoyestown, Quemahoning Lake.....	120	Lynch Lake.....	300
Swengel, Penns Creek.....	250	Mac-A-Nin-ny Lake.....	300
Uniontown, Gorley's pond.....	102	Phantom Lake.....	300
West Chester, Brandywine Creek.....	500	Pike Lake.....	300
White Haven, Lehigh River.....	750	Prentice Lake.....	600
Yardley, White Pond.....	800	Sawdust Lake.....	400
Yerkes, Perkiomen Creek.....	250	Siskowit Lake.....	400
Skippack Creek.....	500	Smith Lake.....	400
Zeiglersville, Perkiomen Creek.....	250	Spider Lake.....	400
Skippack Creek.....	500	Star Lake.....	300
Tennessee:		Swan Lake.....	400
Clarksville, Barton Creek.....	300	Twin Lake.....	400
Little West Fork Creek.....	300	Walker Lake.....	300
Red River.....	300	White River Lake.....	300
Cornersville, Richland Creek.....	300	Athelstane, Elbow Lake.....	300
Estill Springs, Rock Creek.....	300	Birnamwood, Mud Lake.....	300
Gallatin, Bledsoe Creek.....	300	Burlington, Bohner Lake.....	300
Kingsport, Dolen Gap Lake.....	†500	Brown Lake.....	300
Mitchellville, Big Davis Pond.....	200	Butternut, Bass Lake.....	300
Murreesboro, Stoner River.....	300	Bear Lake.....	300
Norma, New River.....	500	Bullhead Lake.....	300
Okolona, Buffalo Creek.....	†500	Butternut Lake.....	300
Rock Island, Caney Fork River.....	250	Schnur Lake.....	300
Collins River.....	1,140	Turtle Lake.....	300
Springfield, Red River.....	400	Cable, Bartlett Lake.....	300
Wartrace, Garrison River.....	300	Cable Lake.....	650
Texas: Texarkana, Spring Lake.....	1,200	Flyn Lake.....	300
Vermont:	100	Lake Owen.....	300
Burlington, Lake Champlain.....	429	Mud Lake.....	350
Joes Pond, Joes Pond.....	†3,000	Perry Lake.....	350
Miles Pond, Miles Pond.....	100	Suede Lake.....	350
Poultney, Lake St. Catherine.....	200	Swenson Lake.....	300
Rutland, Otter Creek.....	150	Darlington, Pecatonica River.....	900
Virginia:		Donaldson, Big Portage Lake.....	300
Alexandria, Water Co. Reservoir.....	240	Chrystal Lake.....	300
Ashby, Shenandoah River.....	†8,000	Crooked Lake.....	300
Balcony Falls, James River.....	165	Deer Lake.....	300
Belmont, Goose Creek.....	†5,000	Dollar Lake.....	600
Broadway, Shenandoah River, North Branch.....	†6,000	Donohue Lake.....	300
Clifton, Bull Run.....	120	Little Portage Lake.....	300
Goshen, Calf Pasture River.....	†6,000	Moon Lake.....	300
Hot Springs, Jackson River.....	130	Round Lake.....	300
Lawyers, Flat Creek.....	120	Spring Lake.....	300
Lynchburg, Odd Fellows Home Lake.....	240	White Bass Lake.....	300
Roanoke, Roanoke River.....	†6,000	Drummond, Ashland Lake.....	350
Woodstock, Shenandoah River, North Fork.....	†10,000	Asmuth Lake.....	300
		Bass Lake.....	300
		Beaver Lake.....	300
		Black Lake.....	300
		Club House Lake.....	300



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SMALLMOUTH BLACK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Wisconsin—Continued.		Wisconsin—Continued.	
Drummond, Eau Claire Lake.....	350	Mellen, Larson Lake.....	300
Elliott Lake.....	350	Long Lake.....	300
First Bass Lake.....	350	Loon Lake.....	300
Pigeon Lake.....	350	Mineral Lake.....	300
Rawlinson Lake.....	300	Taggett Lake.....	300
Robinson Lake.....	300	Mercer, Mercer Lake.....	900
Second Bass Lake.....	300	Odanah, Bad Lake.....	300
Spring Lake.....	300	Indian Lake.....	300
Ellis Junction, High Falls Pond.....	600	Park Falls, Bass Lake.....	300
Glidden, Augustine Lake.....	300	Block House Lake.....	300
Buck Lake.....	300	Gardner Lake.....	300
Deer Lake.....	300	Hay Lake.....	300
Derringer Lake.....	300	Newan Lake.....	300
Mud Lake.....	300	Oxbow Lake.....	300
Muscalonge Lake.....	300	Schnur Lake.....	300
Summit Lake.....	300	Smith Lake.....	300
Torrey Lake.....	300	Pelican, Pelican Lake.....	300
Grandview, Jacobsen Lake.....	300	Shawano, Shawano Lake.....	300
Pratt Lake.....	300	Soperton, Otter Lake.....	300
Spring Lake.....	300	Stone Lake, Lac Court Oreilles.....	400
Hayward, Ghost Lake.....	300	Whitefish Lake.....	400
Hayward Lake.....	300	Trevor, Cooper Lake.....	300
Hubbard Lake.....	300	Twin Lakes, Lake Mary.....	330
Lost Land Lake.....	350	Waupaca, Rainbow Lake.....	300
Perch Lake.....	350	Wautoma, Eagan Lake.....	300
Spring Lake.....	350	Johns Lake.....	300
Teal Lake.....	350	Silver Lake.....	300
Hudson, Burkhardt Lake.....	300	Wonewoc, Castle Rock Pond.....	300
Lake Mallalieu.....	300	Horseshoe Pond.....	300
Ladysmith, Lake of the Woods.....	400	Wyocena, Duck Creek.....	300
Mellen, Caroline Lake.....	300		
English Lake.....	300		
Lake Galilee.....	300	Total a.....	{ †237, 600 149, 837

## ROCK BASS.

Alabama:		Georgia:	
Abbeville, Hutto's pond.....	150	Bellville, Brierwood Pond.....	150
Anniston, Blue Pond.....	300	Gignilliat's pond.....	150
Cane Creek.....	300	Douglas, Vicker's pond.....	250
Morris Creek.....	300	Lake Park, Smoke House Lake.....	600
Rock Creek.....	345	Roswell, Maddox's pond.....	300
Simpson's pond.....	300	Social Circle, Lake Louise.....	250
Birmingham, City Lake.....	40	Sunny Side, Darsey's pond.....	400
Elba, Seary Old Mill Pond.....	500	Old Pump Pond.....	400
Tanton Mill Pond.....	500	Tifton, Sutton's pond.....	500
Newton, High Spring Pond.....	250	Illinois:	
Arkansas:		Arminington, Springvale Farm Pond.....	300
Bellefonte, Spring Pond.....	200	Belleville, Oak Pond.....	100
Conway, Owen Lake.....	350	Orbon Lake.....	400
Delight, Jackson's pond.....	300	Dahlgren, Sullivan's pond.....	400
DeQueen, Big Bear Creek.....	800	White Hall, White Hall Pond.....	400
El Dorado, Meadowbrook Pond.....	300	Indiana:	
Fayetteville, Clear Creek.....	450	Blountsville, Acker's pond.....	150
Richland Creek.....	450	Brownsburg, White Lick River.....	500
White River, West Fork.....	450	Goshen, Stone Lake.....	400
Harrison, Crooked Creek.....	1, 000	Greensburg, Quarry Pond.....	225
Hope, Pleasure Lake.....	400	Huntington, Salamonie River.....	500
Magnolia, Atkins's pond.....	200	Lexington, Englishton Park Pond.....	200
Aubry's pond.....	200	Osgood, Hunter Pond.....	225
Mammoth Spring, Warm Fork Creek.....	403	Sellersburg, Sunnyslope Pond.....	225
Ozark, Conatser-Hill Pond.....	400	Tippecanoe, Roose's pond.....	150
Frances Creek.....	600	Iowa:	
Rottaken, Faulkner Lake.....	400	Edgewood, Honey Creek.....	300
Ferguson Lake.....	400	Manchester, Maquoketa River.....	600
Hills Lake.....	400	Kentucky:	
Ink Bayou.....	600	Brandenburg, Denton Pond.....	50
Rock Creek.....	600	Cerulean, Little River, Muddy Fork.....	1, 000
Colorado:		Danville, McRoberts's pond.....	50
Colorado Springs, Lake Erin.....	300	Franklin, Harrington Pond.....	50
Palmer Lake, Palmer Lake.....	100	Fredino, Rice's pond.....	50
Trinidad, Chaquaqua Creek.....	800	Hopkinsville, Little River.....	100

a Lost in transit, 1,317 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## ROCK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Kentucky—Continued.		Pennsylvania:	
Louisville, Floyds Fork.....	525	Doylestown, Tohickon Creek.....	300
Harods Creek.....	525	Everett, Juniata River, Raystown Branch.....	800
Morganfield, Floumoy's pond.....	50	Hanover, Browns Pond.....	150
Munfordville, Green River.....	300	Dicks Pond.....	300
Shelby Gap, Gleson's pond.....	200	Lilley Pond.....	150
Louisiana:		Little Conewago Creek.....	300
Clinton, Dilly's pond.....	600	Obold Pond.....	300
Frierson, Frierson's pond.....	40	Plum Creek.....	300
Gloster, Burford's pond.....	200	Slagle Creek.....	150
Homer, Gladney's pond.....	70	Sellersville, Berndt's pond.....	300
Lake Charles, King's pond.....	120	Williamsport, Loyalsock Creek.....	450
New Orleans, Aquarium.....	55	Lycoming Creek.....	300
Maryland:		South Carolina:	
Bradshaw, Marye's pond.....	200	Anderson, Masters Pond.....	400
Dickerson, Potomac River.....	50	Clio, Eddy Pond.....	400
Edgemont, Ball Hill Pond.....	100	Welch Pond.....	400
Seneca, Potomac River.....	150	Creston, Boggy Gully Pond.....	400
Woodbine, Mullinix's pond.....	100	McBee, Horton's pond.....	400
Missouri:		Norwood's pond.....	400
Aurora, Honey Creek.....	500	Swift Creek.....	1,600
Ferguson, Wabash Club Lake.....	24	South Dakota: Virgil, McCreery's pond.....	200
Jaudon, Grand River, tributary of.....	300	Tennessee:	
Rich Hill, Logan Lake.....	600	Cowan, Boiling Fork Creek.....	200
Rolla, Little Piney River.....	600	Castleberry Branch.....	200
Middle Gasconade River.....	600	Fishery, Sinking Creek.....	2,800
Montana: Myers, Walker Pond.....	200	Spring Branch.....	8,200
New Mexico:		Gallatin, McGar's pond.....	150
Elida, Kornegay's pond.....	105	Hollow Rock, Watkins Pond.....	70
Roswell, Cottonwood Lake.....	50	McMinnville, Mountain Creek.....	120
New York:		Maryville, Webb's pond.....	600
Garrison, Dole's pond.....	300	Shelbyville, Duck River.....	150
Huntington, Little Rosemary Pond.....	200	Springfield, Red River, Elk Fork.....	200
North Carolina:		Watertown, Fall Creek.....	600
Bostic, Felton Pond.....	200	Texas:	
Chapel Hill, Richards Pond.....	150	Abernathy, Chililee Pond.....	100
Corinth, Buckhorn Falls Pond.....	600	Bastrop, Club Lake.....	900
Duncan, Baker's pond.....	600	Brady, Dutton's pond.....	150
Fayetteville, Bruton's pond.....	400	Brenham, Club Lakes.....	1,465
Guilford College, Jessup's pond.....	300	Spring Lake.....	500
Lenoir, Clark Gold Mine Pond.....	1,000	Brownwood, McChristy's pond.....	200
Lumberton, McAllister's pond.....	400	Denison, Templemeyer's pond.....	500
Pittman's pond.....	600	Edgewood, Oak Leaf Lake.....	200
Matthews, Renfrow's pond.....	400	Fredericksburg, Bierschwald's pond.....	100
Morrisville, Sycamore Pond.....	400	Jacksonville, Churchill's pond.....	300
Old Fort, Camp Creek.....	600	Devereux's pond.....	300
Pee Dee, Blewett Falls Pond.....	3,000	Douglas's pond.....	300
Pittsboro, Hailbourn Pond.....	200	Forrest's lake.....	801
Ohio:		Grayard's lake.....	300
Alexandria, Raccoon Creek.....	100	Morris's lake.....	300
Bellaire, Fairpoint Pond.....	200	Williamson's lake.....	300
Belleville, Gaiton's pond.....	100	La Mesa, Sherman Pond.....	150
Berea, Rocky River.....	600	Longview Jct., T. & P. Lake.....	50
Cambridge, Gillespie Lake.....	200	Mincola, Wood Springs Pond.....	200
Rock Hill Pond.....	200	New Braunfels, Comal River.....	1,825
London, Ellsworth's pond.....	200	Paris, Clear Lake.....	150
Mansfield, North Park Lake.....	700	Crystal Lake.....	150
Mantua, Meadowbrook Pond.....	200	Pleasanton, Martin's pond.....	150
Midland City, St. Joseph Pond.....	150	San Antonio, West End Lake.....	500
Newark, Licking River.....	900	Sherman, Club Lake.....	300
Weinant's pond.....	200	Grass Lake.....	200
Oneida, Sand Rock Pond.....	200	Lily Pond.....	300
Plymouth, Huron River, East Branch.....	500	McElreath's pond.....	100
Rogers, Pine View Pond.....	100	Mesquite Lake.....	300
Washington Courthouse, Parry's pond.....	200	Smith Pond.....	300
Youngstown, Indian Creek.....	400	Terrell, Bond's pond.....	200
Oklahoma:		Lake Bell.....	300
Ada, Rushing's pond.....	200	Mallory Lake.....	300
Ardmore, Ardmore Club Lakes.....	800	Tyler, Chinquapin Lake.....	300
Dings Lake.....	400	Hitts Mill Pond.....	300
Wolverton Lake.....	400	Virginia:	
Armstrong, Hatchery Ponds.....	80	Clifton, Rhodes's pond.....	200
Choteau, Adkins Lake.....	400	Dunn Loring, Cornell's pond.....	100
Davis, Freeman Lake.....	400	Eagle Mountain, Catawba River.....	600
Fairview, Hill Top Lake.....	200	Elliston, Roanoke River.....	600
Supply, State Spring Pond.....	124	Fagg, Roanoke River, North Fork.....	400
Wardville, Willow Pond.....	200	Greenwood, William's pond.....	150

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## ROCK BASS—Continued.

Disposition.	Number.	Disposition.	Number.
Virginia—Continued.		Virginia—Continued.	
Houston, Powell's pond.....	150	Starkey, Back Creek.....	400
Ironto, Roanoke River, North Fork.....	500	Wytheville, Tates Run.....	300
Keysville, Glenn Spring Pond.....	200	West Virginia: Martinsburg, Baker Lake.....	1,500
Leesburg, Harper's pond.....	100	Wisconsin:	
Paces, Walton's pond.....	400	Bangor, Farris Pond.....	80
Plains, Goose Creek.....	1,000	Genoa, Mississippi River.....	a 300
Proffit, Gale Hill Pond.....	150	Leslie, Bahner Branch.....	600
Randolph, Spring Pond.....	200	Lynchville, Mississippi River.....	a 300
Richmond, Harnish's pond.....	400	Canal Zone: Ancon, Panama Canal.....	500
Roanoke, Peters Creek.....	500		
Roanoke River.....	600	Total <sup>b</sup> .....	91,742
Tinker Creek.....	400		
Salem, Roanoke River.....	600		

WARMOUTH BASS.<sup>a</sup>

Illinois: Galena, Mississippi River.....	2,000	Iowa: Bellevue, Mississippi River.....	400
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## SUNFISH.

Alabama:		Alabama—Continued.	
Abbeville, Jack Creek.....	450	Elba, Cox Mill Pond.....	100
Martins Lake.....	750	Fawcett Lake.....	100
Alexandria City, Heflin Pond.....	50	Hudson Lake.....	100
Thomas Pond.....	50	Hudson Mill Pond.....	100
Aliceville, Crim Lake.....	300	Hurricane Pond.....	100
Anniston, Blue Pond.....	700	Kierce Mill Pond.....	100
Choccolocco Creek.....	300	Long Pond.....	100
Ashby, Merchants Pond.....	100	Page Mill Pond.....	100
Ashland, Mattison's pond.....	175	Power Company Lake.....	100
Athens, Crowson's pond.....	150	Sawyer Mill Pond.....	100
Bellevue, Mooresville Pond.....	150	Spinx Mill Pond.....	100
Billingsley, Nummy's pond.....	150	Sweetwater Creek.....	100
Birmingham, City Lake.....	25	Trazor Mill Pond.....	100
Edgewood Lake.....	600	Enterprise, Blanket Pond.....	200
Finch's pond.....	300	Center Head Pond.....	200
Hickman Pond.....	150	Eoline, Wyatt's pond.....	120
Munger's pond.....	300	Epas, Kimbrough's lake.....	150
Ritter Pond.....	300	Eufaula, Hatfield's pond.....	150
Shades Creek.....	900	Country Club Ponds.....	600
Borden Springs, Terrapin Creek.....	120	Dent's pond.....	80
Boswell, Boswell's pond.....	40	Fayette, Oak Ridge Pond.....	150
Brantley, Gilchrist's pond.....	200	Sipsey Creek.....	600
Johnson's pond (A).....	200	Fays, Yarbrough's pond.....	150
Johnson's pond (B).....	100	Florence, Weeden's pond.....	150
Johnson's pond (C).....	200	Fort Payne, Edgewood Lake.....	150
Briarfield, Mahan Creek, Spring Branch.....	300	Wills Creek.....	750
Buffalo, Newman's pond.....	50	Garden City, Copeland Pond.....	150
Capps, Spivey Mill Pond.....	150	Glenwood, Branch Pond.....	200
Chatom, Big Bassett Creek.....	600	Goshen, Floyd's pond.....	150
Cherokee, Prides Lake.....	80	Sikes Mill Pond.....	200
Clanton, Mountain Lake.....	150	Grady, Tucker's pond.....	150
Clayton, Bush's pond.....	300	Grimes, Herrings Pond.....	150
Martin's pond.....	150	Headland, Black Pond.....	60
Tanyard Pond.....	150	Deep Spring Pond.....	150
Columbia, Blackshear Branch.....	150	Kirkland's pond.....	150
Clover Spring Branch.....	150	McNeill's pond.....	150
Hollywood Pond.....	150	Riley's pond.....	100
Cuba, McGowen's pond.....	300	Huntsville, Broadview Pond.....	150
Cullman, Cleere's pond.....	150	Jasper, Bankhead's pond (A).....	300
St. Bernard Lake.....	150	Bankhead's pond (B).....	450
Tucker's pond.....	150	Blackwater River.....	600
Dora, Hill Lake.....	150	Christian's pond.....	150
Vandiver's pond.....	150	Hall Lake.....	150
Elba, Buck Branch.....	100	Kennedy, Gum Spring Pond.....	150
Busch Branch.....	100	Kinston, Richardson's pond (A).....	200
Cains Lake.....	100	Richardson's pond (B).....	200
Cotton Lake.....	100	Lapine, Russell's pond.....	150

<sup>a</sup> Rescued from overflowed lands and restored to original waters.<sup>b</sup> Lost in transit, 400.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
Alabama—Continued.		Alabama—Continued.	
Leighton, Lander's pond.....	150	Uniontown, Cromer's pond.....	300
ineville, Alexander's pond.....	175	Foushee Pond.....	150
Lake Mae.....	100	McCorkle Lake.....	450
Lineville Lake.....	525	Valley Head, Little River.....	300
Smith's lake.....	200	Little River, West Branch.....	150
Horne Lake.....	150	Verbena, Sandy Creek.....	300
Livingston, Turner's pond.....	300	Winfield, Aston's pond.....	150
Loachapoka, Rowell's pond.....	150	York, Allison's lake.....	600
Louisville, Fuqua's pond (A).....	150	Arizona:	
Fuqua's pond (B).....	550	Benson, Walnut Grove Farm Reser-	
Hick's pond.....	150	voir.....	300
Lime Spring Pond.....	100	Globe, Roosevelt Lake.....	3,700
Michele Branch.....	550	Herford, High Lonesome Pond.....	300
Lowndesboro, Reese's pond.....	150	Winkelman, Cook's lake.....	200
Luverne, Cody's lake.....	250	Arkansas:	
Knights Pond.....	300	Arkadelphia, Arnold's pond.....	600
Mildred Lake.....	300	Aubrey, Snipes's pond.....	70
Wright's pond.....	450	Black Rock, Black River.....	a 3,904
Madison, Cave Spring Pond.....	80	Daggett, Cache River.....	600
Farmers Pond.....	80	Earle, Hood Lake.....	1,500
Herring's pond.....	120	Long Lake.....	1,500
James Pond.....	80	Emerson, Spring Lake.....	1,000
Willow Lake (A).....	120	Fayetteville, Clear Creek.....	2,000
Willow Lake (B).....	300	White River, West Fork.....	2,000
Marion, Woodfin's pond.....	150	Highland, Bell's pond.....	300
Montgomery, Candler's lake.....	120	Junction City, Brown's pond.....	700
Dixie Pond.....	150	Magnolia, Baker's pond.....	400
Montgomery Lake.....	300	Goode's pond.....	200
Three Mile Creek.....	120	Hutchinson's pond.....	600
Tyson's pond.....	150	Spring Lake.....	1,000
Newton, Fireleads Pond.....	150	Stevens's pond.....	200
Oneonta, Black Warrior River.....	50	West End Pond.....	200
Eureka Home Pond.....	50	Mammoth Spring, Warm Fork Creek.....	62
Sand Lake.....	150	Many Islands, Myatt River.....	500
Opelika, Thomas's pond.....	150	Nashville, Glendale Pond.....	1,000
Opp, McDaniel's pond.....	550	Huddleston's pond.....	160
Webster's pond.....	600	Williams's pond.....	1,500
Orville, Blount's pond.....	150	Prescott, Bryson's pond.....	1,800
Oxford, Snow Creek.....	300	Rogers, Osage Creek.....	2,000
Patsburg, Spradley's pond.....	150	Rudy, Deden's pond.....	160
Pell City, Waite Dairy Farm Lake.....	150	Stamps, Silver Maple Pond.....	1,500
Petrey, Fowler's pond.....	150	Sulphur Springs, Lake Ark-Mo-Kan.....	1,000
Phil Campbell, Smith Lake.....	100	Tuckerman, Layton Lake.....	1,000
Pinckard, York's pond.....	150	Waldo, Rhodes's pond.....	2,000
Pine Hill, Indian Creek.....	300	Yellville, Matlock's pond.....	400
Sheffield's pond.....	150	Colorado:	
Plantersville, Gay's pond.....	150	Denver, Lakewood Lakes.....	30
Prattville, Wingard's pond.....	150	Willow Pond.....	100
Quinton, Lake Bankhead.....	300	Dolores, Shane's pond.....	300
River Falls, Cooper's pond.....	200	Fountain, Eureka Lake.....	100
Roanoke, McCarter's pond.....	100	Haswell, Blue Lakes.....	1,000
Ussery's lake.....	100	Loveland, Southside Lake.....	600
Roswell, Burge's pond.....	175	Morrison, Harriman Lake.....	200
Round Mountain, Hendrix's pond.....	300	Connecticut: Greenwich, Domme-	
Seale, Chadwick's pond.....	120	rich's pond.....	200
Selma, Ward's pond.....	150	Delaware: Wilmington, Circle Pond.....	350
Stewart, Cumming's pond.....	150	District of Columbia: Washington,	
Suggsville, Cedar Lake.....	400	Rhodment Lake.....	25
Sulligent, Ogden's pond.....	300	Florida:	
Talladega, Boswell's pond.....	100	Alturas, Star Lake.....	400
Talladega Creek.....	1,200	Lady Lake, Lake Alice.....	600
Tanner, Peck's pond.....	150	Lake Mattie.....	600
Tennille, Prestwood's pond.....	150	Orlando, Lake Bertha.....	200
Three Notch, Davis's pond.....	100	Georgia:	
Reynold's pond.....	100	Abbottsford, Maxwell's pond.....	100
Troy, Carter Pond.....	150	Adairsville, Saylor's pond.....	50
Cowart's pond.....	150	Alamo, Kent's pond.....	300
Henderson Lake.....	450	Alston, Southside Pond.....	200
Lightfoot's pond.....	150	Ash Grove, Spring Lake.....	600
McLeod's pond.....	150	Atlanta, Candler's pond.....	400
Northcutt's lake.....	450	Chattahoochee Club Lake.....	300
Powell's pond.....	150	Head's pond.....	200
Thundering Springs Pond.....	300	Lake Ivy.....	200
Trussville, Wyldwood Lake.....	150	McClelland's pond.....	170
Tuscumbia, Mitchell's pond.....	150	Athens, Brooks's pond.....	600
Union Springs, Gholston's pond.....	150	Augusta, Arnold's pond.....	600
Lee's pond.....	120	Carmichael Pond.....	600
Martin's pond.....	150	Avera, Clark's pond.....	400

a Rescued from overflowed lands and returned to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
Georgia—Continued.		Georgia—Continued.	
Bakley, Speer's pond.....	400	Marietta, Delk's pond.....	200
Bellville, Black Pond.....	400	McTyre's pond.....	50
Kennedy's pond.....	400	Maxeys, Nichols's pond.....	100
Box Springs, Lake Samoki.....	600	Mayfield, Lake View.....	400
Bremen, Buck Creek, Headwaters.....	200	Meldrim, Ogeechee River.....	1,000
Posey Pond.....	100	Metter, Turner's pond.....	100
Brownwood, Kinchafoonee Creek.....	600	Montezuma, Felton's pond.....	175
Waller's Mill Pond.....	400	Frederick Mill Pond.....	375
Broxton, Leggett's pond.....	150	Lewis's pond.....	375
Vickers's pond.....	200	Riverside Lake.....	175
Buena Vista, Davis's pond.....	200	Monticello, Jackson Spring Pond.....	50
Cairo, Shiver Pond.....	450	Norwich, Montgomery's pond.....	300
Carrollton, Happy Hollow Pond.....	100	Ocala, Poplar Spring Pond.....	300
Cartersville, Pettits Creek.....	150	Preston, Jenkins's pond.....	400
Clarkston, Morris's pond.....	100	King Pond.....	375
Colbert, Carithers's pond.....	100	Quitman, Bentley Lake.....	300
College Park, Heard Spring Pond.....	200	Blue Pond.....	300
Comer, Bankhead Pond.....	100	Elam Branch Lake.....	400
Congers, Farmer's pond.....	200	Fernside Lake.....	400
Covena, Hall's pond.....	400	Knights Lake.....	300
Crawfordville, Asbury's pond.....	100	Rebecca, White's pond.....	200
Ogeechee River.....	1,350	Reynolds, Beaver Pond.....	400
Culloden Battle's pond.....	150	Richland, Highnote's pond.....	175
Cusseta, King's pond.....	100	Roberta, Hardies Pond.....	200
Wynn's pond.....	150	Harris's pond.....	100
Cuthbert, Crumbley's pond.....	200	Rockmart, Holly Springs Pond.....	100
Dallas, Griss Pond.....	150	Parris's pond.....	300
Decatur, Akin's pond.....	300	Roswell, Manning's pond.....	175
Babashula Pond.....	200	Rupert, Copper's pond.....	200
Douglas, Lake Peterson.....	450	Savannah, Chapman's pond.....	200
Sims's pond.....	300	Jones Lake.....	200
Spring Head Pond.....	300	Scottdale, Scottdale Mills Pond.....	100
Touclinton's pond.....	300	Screven, Little Satilla River.....	600
Vickers's pond.....	300	Siloam, Oliver Pond.....	150
Ward's pond.....	300	Smyrna, Fambrough's pond.....	50
Dublin, Dreamland Lake.....	200	Social Circle, Gibb's pond.....	200
Dunwoody, Nancy Creek, Headwaters.....	150	Malcom's pond.....	200
Elberton, Poplar Spring Pond.....	100	Soperton, Bahtail Pond.....	300
Whiteside's pond.....	100	Henry's pond.....	150
Ellabelle, Black Creek.....	450	Aiken Pond.....	400
Ellaville, Dozier's mill pond.....	400	Sparta, Lewis Pond.....	200
Montgomery Mill Pond.....	400	Ogeechee Lake.....	600
Usry's mill pond.....	400	Spread, Rhodes's pond.....	300
Fayetteville, Tilghman's pond.....	300	Statesboro, Cannon's pond.....	150
Fitzgerald, Lynwood Lake.....	200	Temple's pond.....	400
Fort Gaines, Smith's ponds.....	400	Stone Mountain, Venable Lake.....	300
Gibson, Gin Pond.....	400	Sunny Side, Malain Mill Pond.....	400
Gillsville, Meaders's pond.....	100	Minter's pond.....	400
Gray, Bonner's pond.....	50	Swainsboro, Bell's pond.....	300
Graymont, Weatherford's pond.....	800	Chalker's pond.....	175
Greensboro, Sanders Pond.....	300	Durden Pond.....	800
Griffin, Connelly's pond.....	175	Open Creek Pond.....	400
Grovetown, Blount's pond.....	100	Rountree Pond.....	50
Hampton, Derrick's pond.....	150	Tarrytown, Warnock's pond.....	300
Hopeville, Lee's pond.....	175	Thomasville, Rains Pond.....	300
Hawkinsville, Anderson's pond.....	150	Hall Pond.....	300
Richardson's pond.....	150	Woodland Pond.....	300
Holly Springs, Little River.....	800	Thomson, Brier Creek.....	1,200
James, James's pond.....	200	Sweetwater Pond.....	400
La Grange, Aubrey's pond.....	150	Tifton, Whitley's pond.....	300
Lake Park, Ashley's pond.....	300	Valdosta, Fenders Lake.....	400
Clayton Lake.....	400	Richardson Pond.....	400
Francis Lake.....	400	Vidette, Robinson Pond.....	300
Jones Lake.....	300	Wadley, Perkins Pond.....	200
Lake Alberta.....	400	Warthen, Sparks's pond.....	200
Lake Tom.....	400	Washington, Pope's pond.....	100
Lofton Lake.....	400	West Point, Eastridge's pond.....	150
Wesenbokee Lake.....	400	White Plains, Jarrell Pond.....	150
Lawrenceville, Davis's pond.....	150	Tappan's pond.....	150
Lithonia, Jones's pond.....	100	Willacoochee, Spring Pond.....	300
Louisville, Weeks's pond.....	150	Winder, Gooch's pond.....	150
Luthersville, Upshaw's pond.....	150	Wray, Rogers's pond.....	300
McIntyre, Eady's mill pond.....	300	Wrens, Big Creek.....	600
McRae, Creekside Pond.....	950	Wrightsville, Ohoopce Creek.....	1,000
Macon, Herring's pond.....	400	Illinois:	
Willingham's pond.....	150	Alexis, Sedwick's pond.....	200
		Apple River, Apple River.....	500

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Illinois—Continued.</b>		<b>Kentucky—Continued.</b>	
Chicago, Aquarium.....	25	Dixon, Jackson's pond.....	100
Council Hill, Fever River.....	300	Dry Ridge, Carlsbad Lake.....	200
Crystal Lake, Crystal Lake.....	6,000	Exton, Funk's pond.....	100
Dallas City, Lake Cooper.....	a 689	Elkton, Sunnyside Pond.....	100
Dix, Purcell's pond.....	100	Ferguson, Davies's pond.....	100
Elizabeth, Apple River.....	900	Franklin, Beard Pond.....	100
Farmer City, Salt Creek.....	200	Boaz Pond.....	100
Galena, Mississippi River.....	a 193,000	Eldridge's pond.....	250
Greenfield, City Lake.....	200	Gomer Pond.....	100
Greenfield, Mill Pond.....	200	Hays Pond.....	100
McLeansboro, Jones's pond.....	200	McClanahan Pond.....	100
Mercedosia, Mercedosia Bay.....	a 34,800	Neely's pond.....	100
Millington, Fox River.....	200	Red Pond.....	100
Nora, Apple River.....	300	Slacks Pond.....	100
North Hanover, Apple River.....	400	Sloan Pond.....	100
Ozark, Reynoldsburg Pond.....	100	Sloss Pond.....	100
Rodden, Apple River.....	300	Widener Pond.....	100
Scales Mound, Fever River.....	200	Georgetown, Hall's pond.....	200
Shelbyville, Kaskaskia River.....	100	Gilbertsville, Gregory's pond.....	100
Stockton, Plum River.....	400	Glasgow, Duff's pond.....	100
Warren, Apple River.....	700	Greenville, Coomb's pond.....	100
Waverly, Brown's pond.....	100	Newman's pond.....	100
<b>Indiana:</b>		Guthrie, Church Hill Pond.....	200
Bath, De Armond Lake.....	200	Hawesville, Indian Lake.....	800
Borden, McClutchan's pond.....	200	Hodgenville, Goodin's pond.....	100
Connorsville, Village Creek.....	400	La Rue's pond.....	100
Whitewater River, West Fork.....	400	Long Pond.....	300
Corydon, Herter's pond.....	300	Hopkinsville, Hays Pond.....	100
Crawfordsville, Rock River.....	400	Kenton, Rigg's pond.....	150
Dabney, Devaney's pond.....	200	Kuttawa, Cumberland River.....	a 2,831
Eckerty, Eckerty's pond.....	125	Lakeland, Hospital Lake.....	2,000
Edinburg, Sugar Creek.....	400	Lawrenceburg, Blakemore Pond.....	200
Evansville, Evansmore Pond.....	300	Cox's pond.....	100
Goshen, Stone Lake.....	200	Trent's pond.....	200
Greenfield, Walker's pond.....	200	Leitchfield, Beauchamp's pond.....	200
Huntingburg, Finke's pond.....	250	Louisville, Floyds Fork.....	2,100
Water Works Lake.....	500	Harrods Creek.....	2,100
La Fontaine, Gards Gravel Pond.....	100	Madisonville, Laughlin Lake.....	100
La Grange, Appelman Lake.....	200	Morganfield, Flournoy's pond.....	200
Cotton Lake.....	200	Mount Sterling, Clark's pond.....	150
La Porte, Pine Lake.....	200	Grassy Lick Creek.....	450
Liberty, Sugar Creek Pond.....	200	Otter Pond, Sim's pond.....	100
Morris, South End Pond.....	200	Pembroke, Brewer's pond.....	100
Muncie, Gravel Pit Pond.....	200	Pulaski, Pleasant View Lake.....	200
Nappanee, Stump's pond.....	100	Russellville, Browning's pond.....	100
New Point, Kleumper's pond.....	200	Tillie, Collins's pond.....	100
Paoli, Wells's pond.....	200	Whitesburg, Polly's pond.....	100
Plymouth, Dixon Lake.....	200	<b>Louisiana:</b>	
Pretty Lake.....	200	Bogalusa, Pine Tree Lake.....	150
Ridgeville, Warren's pond.....	200	Lecompte, Bayou Beauf.....	300
South Bend, Clear Lake.....	100	New Orleans, Aquarium.....	40
<b>Iowa:</b>		Ponchatoula, Prince's pond.....	50
Adelphi, Ballard's pond.....	150	<b>Maryland:</b>	
Bellevue, Mississippi River.....	a 731,700	Bladensburg, Cedar Hill Lake.....	100
Boone, Des Moines River.....	600	Dickerson, Potomac River.....	300
Carroll, Judge's pond.....	150	Motters, Dorsey's pond.....	100
Edgewood, Honey Creek.....	200	Royal Oak, Solitude Pond.....	100
Fairfield, Fairfield Pond.....	1,000	Seneca, Potomac River.....	a 1,225
Fryman's pond.....	300	Towson, Turnbull Pond.....	100
Fairport, Mississippi River.....	a 65,694	<b>Massachusetts: Plymouth, Moreys Pond.....</b>	
Mississippi River.....	a 3,730		200
Lime Springs, Upper Iowa River.....	2,200	<b>Michigan:</b>	
Manchester, Maquoketa River.....	2,500	Au Sable, McPhee Lake.....	200
North McGregor, Mississippi River.....	a 473,700	Gwinn, Miller Lake.....	200
Underwood, Benson's pond.....	300	Highland, Lake in Oakland County.....	9,000
West Burlington, Railroad Pond.....	200	Houghton, Long Lake.....	200
<b>Kansas:</b>		Iron River, Iron River, branch of.....	200
Amiot, Knight's pond.....	100	Jackson, Wolf Lake.....	600
Chanute, Alden Lake.....	1,000	Kingsley, Arbutus Lake.....	300
Girard, Burnett's lake.....	400	Big Muncie Lake.....	200
<b>Kentucky:</b>		Rennie Lake.....	200
Ashland, Ohio River.....	450	Spider Lake.....	200
Beaver Dam, Mill Pond.....	200	Marquette, Pohlman Pond.....	100
Brandenburg, Applegate's pond.....	200	Sylvania, Deep Gully Creek.....	200
Bewley's pond.....	300	White Cloud, Allie Lake.....	400
Drury's pond.....	100	Big Robinson Lake.....	400
Sebastian's pond.....	300	Little Robinson Lake.....	400
Corydon, Horse Lot Pond.....	250	Long Lake.....	400

a Rescued from overflowed land and returned to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
Minnesota:		Mississippi—Continued.	
Adrian, Lander's pond.....	200	Cranfield, Cranfield Pond.....	150
Degraff, St. Marys Lake.....	600	Crawford, Richards's pond.....	150
Detroit, Wheeler Lake.....	450	Decatur, Spivey's pond.....	400
Duluth, Horseshoe Lake.....	620	Eupora, Sylvadale Pond.....	200
Elk River, Shandy Lake.....	600	Flora, Gary Lake.....	150
Faribault, Milligan Lake.....	400	Hillside Pond.....	150
Fertile, Mill Pond.....	300	Oakhurst Lake.....	150
Plathe Park Pond.....	200	Pleasant Valley Pond.....	150
Homer, Mississippi River.....	a 106,475	Rohrbocker Pond.....	150
Lake City, Lake Pepin.....	a 11,977	Wild Duck Pond.....	150
Little Falls, Fish Lake.....	600	Foster, Junkin's pond.....	150
Minneapolis, Glenwood Lake.....	300	Friars Point, Mississippi River.....	a 46,083
Lake Calhoun.....	250	Goodman, Crawford's pond.....	100
Pecks Lake.....	600	Hardy, Powell's lake.....	200
Morton, Schafer's pond.....	150	Thomason's pond.....	200
Owatonna, Rice Lake.....	600	Hattiesburg, Lovett's pond.....	300
Richmond, Mississippi River.....	a 40,150	Hazlehurst, Breynard Pond.....	150
Rochester, Rochester Mill Pond.....	600	Hargrave's lake.....	400
Sturgeon Lake, Steve Lake.....	450	Heidelberg, Morrison's pond.....	150
Winona, Lake Winona.....	2,200	Ratcliffe's pond.....	300
Mississippi River.....	a 38,030	Hernando, Dockery's pond.....	400
Sugar Loaf Mill Pond.....	500	Ingomar, Guyton's pond.....	150
Mississippi:		Jackson, Crescent Lake.....	400
Aberdeen, Black Lake.....	100	Kosciusko, Bailey Lake.....	600
Blue Lake.....	100	Gray's pond.....	200
Bream Lake.....	100	Sander's pond.....	100
Clear Lake.....	100	Lauderdale, Watson's pond.....	100
Cribs Pond.....	150	Little Rock, Matley's pond.....	150
Deer Lake.....	100	Lokey, Haney's pond.....	600
Goose Lake.....	100	Louisville, Foster's pond.....	200
Grubs Spring Pond.....	150	McCool, Kennedy's pond.....	200
Hickory Lake.....	150	Sander's pond.....	200
Honey Pond.....	150	Smith's pond.....	200
Jellow Pond.....	150	Macon, Cedar Brook Pond.....	100
Jones Lake (A).....	100	Oil Mill Pond.....	100
Jones Lake (B).....	100	Scales's pond.....	100
Lily Pond.....	150	Madison, Bennett's pond.....	100
McGown's pond.....	100	Magnolia, Lake Charles.....	150
Moon Lake.....	100	Magnolia Pond.....	200
Murff's pond (A).....	100	Martinsville, Dunn's pond.....	200
Murff's pond (B).....	100	Mathiston, Davis's pond.....	200
Murff's pond (C).....	100	Meridian, Queen City Pond.....	200
Murff's pond (D).....	100	Wanita Pond.....	300
Robert's pond.....	100	Mize, Sullivan's pond.....	150
Rodgers Lake.....	150	Montrose, James's pond.....	200
Sanders Pond.....	150	Mount Olive, Tyrone's pond.....	200
Silver Pond.....	150	Natchez, Point Plantation Ponds.....	150
Smith Pond.....	150	New Albany, Coker's pond.....	200
Sulphur Spring Pond.....	150	Phyfer's pond.....	200
Sunberry Lake.....	150	Robbin's pond.....	200
Walters Pond.....	150	New Augusta, Tucker's pond.....	200
Ackerman, Griffin's pond.....	200	Ovett, Tucker's pond.....	400
Shaw's pond.....	200	Pheba, Terry's pond.....	400
Amory, Dalrymple Lake.....	200	Philadelphia, Phillips's pond.....	150
Duke's pond.....	100	Pickens, Scott's pond.....	100
Lily Pond.....	100	Pontotoc, Dillard's pond.....	200
Parker Spring Pond.....	100	Hubbard's pond.....	200
Reese Lake.....	300	Prairie, Goode's pond.....	100
Wadkins Lake.....	300	Raymond, Gibbs Pond.....	150
White Lake.....	200	Gillespie's pond.....	150
Baldwyn, Tison's pond.....	150	North's pond.....	150
Batesville, Boothe's pond.....	200	Ratliff's pond.....	150
Booneville, Davis's lake.....	300	Sivley's pond.....	150
Jones Lake.....	300	Well's pond.....	150
Jones's pond.....	150	Rienzi, Rinehart's pond.....	300
Braxton, Comby Pond.....	400	Rome, Ferguson's pond.....	100
Brooksville, Cunningham's pond.....	100	Selma, Wilton Woods Pond.....	150
Cantor, Layman's pond.....	100	Senatobia, Yeazey Pond.....	200
Priestley's lake.....	400	Shubuta, Graham's pond.....	100
Centreville, Melba Pond.....	100	Shuqualak, Adam's pond.....	100
Clinton, Johnson's pond.....	150	Starkville, Caldwell Pond.....	200
Collierville, Koen's pond.....	100	Club Lake.....	200
Collins, Upton's pond.....	200	Glenn's pond.....	200
Columbus, Wades Lake.....	300	Gunn's pond.....	200
Como, Craigcrest Pond.....	100	Hickory Grove Pond.....	100
Trotter's pond.....	100	Hill Pond.....	200
Corinth, Miller's pond.....	150	Richey's pond.....	200
Courtland, High School Lake.....	600	Steens, Spring Rill Pond.....	150

a Rescued from overflowed lands and returned to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
Mississippi—Continued.		New Mexico—Continued.	
Stringer, Brown's pond.....	200	Las Vegas, Sweeney Baxter Pond.....	200
Strongs, Clay's pond.....	100	Lucy, McGillivray's pond.....	100
Lone Pine Lake.....	100	Maxwell, Lake Twenty.....	400
Watson Lake.....	100	Melrose, De Graftenried's pond.....	100
Sharp's pond.....	200	Sweet's pond.....	50
Sumrall, Hemb's pond.....	200	Nara Visa, Douglass's pond.....	100
Terry, Dulaney's lake.....	400	Portales, Dunlap Lake.....	100
Jones's pond.....	150	Roswell, Figure Eight Lake.....	50
Tibbee, Lake Lena.....	100	North Berrendo River.....	200
Tomnolen, Hall's pond.....	300	South Spring River.....	50
Tupelo, Barnes's pond.....	100	San Jon, Stemple's pond.....	100
Cosby's pond.....	100	Santa Rita, Mimbres River.....	100
Turnbull, Magnolia Pond.....	200	Socorro, Story's pond.....	50
Union, Fair View Pond.....	200	Torreón Pond.....	50
Live Oak Pond.....	200	Texico, Young's pond.....	100
Wahalak, Buck Pond.....	100	Wagon Mound, Jordan's pond.....	75
Waynesboro, Cochran's pond.....	100	Yeso, Willoughby's pond.....	50
Davis's pond.....	100	North Carolina:	
Weathersby, Cypress Lake.....	300	Auburn, Ferrell's pond.....	200
West Point, Ivy's pond (A).....	200	Bessemer, Baldwin's pond.....	100
Ivy's pond (B).....	200	Bladenboro, Bridger's pond.....	400
Lawn Lake.....	100	Singletary Pond.....	400
Margaret Tipton Pond.....	100	Bostic, Gurley-Hollifield Pond.....	100
Munger's pond.....	100	Chapel Hill, Andrews's pond.....	200
Pike Pond.....	100	Charlotte, Thompson Pond.....	200
Whites, Weeping Willow Lake.....	100	Clayton, McCullen's pond.....	200
Winchester, Mill Pond.....	100	Whiteoak Pond.....	600
Howard's pond.....	200	Coats, Stewart's pond.....	1,000
Woodland, Bermuda Hill Pond.....	200	Connely Springs, Alexander's pond.....	100
Argue's pond.....	100	Corinth, Buckhorn Falls Pond.....	200
College Pond.....	100	Duncan, Baker's pond.....	200
Harris's pond.....	100	Elizabeth City, Pasquotank River.....	3,200
Henderson's pond.....	100	Elkland, Moretz's pond.....	200
Pecan Lake.....	100	Flat Rock, Phinney's pond.....	200
Road Pond.....	100	Franklinton, Guley's pond.....	200
South View Pond.....	100	Willow Valley Pond.....	100
Spider Lake.....	100	Greensboro, Ogburn's pond.....	400
Missouri:		Sunnyside Pond.....	500
Arlington, Big Piney River.....	1,000	Harris, Henson's pond.....	150
Berwick, Clear Creek.....	3,200	Holly Springs, Mills's pond.....	400
Clinton, Miola Lake.....	600	Jackson Springs, Hankins's pond.....	200
De Soto, Murphy Lake.....	450	Kinston, Carraway's pond.....	100
Ferguson, Wabash Club Lake.....	1,454	Louisburg, Shearin's pond.....	300
Fortesque, Bigelow Lake.....	1,700	Lumberton, Alligator Pond.....	400
Jasper, Vincent's pond.....	200	Riverside Pond.....	500
Joplin, Sloan's pond.....	200	McFarlan, Moore's pond.....	200
Kansas City, Alton-Slater Pond.....	1,200	Manchester, Barney's pond.....	300
Friedman's pond.....	200	Marshville, Beaverdam Pond.....	150
Lake of the Woods.....	120	Mayworth, Cotton Pond.....	300
La Belle, Lake Mattingly.....	300	Mebane, Corbett's pond.....	50
Merwin, Corbin's pond.....	2,000	Nihols Pond.....	200
Monett, Lane's pond.....	600	Mocksville, Reavis's pond.....	300
Sunnyside Pond.....	150	Monroe, Houston's pond.....	150
Neosho, Morse Park Pond.....	1,300	Willow Pond.....	200
Schuler's pond.....	150	Woods Pond.....	150
Northview, Barnhart's pond.....	200	Morganton, Carpening Mill Pond.....	200
Pleasant Hill, Kellogg Lake.....	1,200	Morrisville, Sears's pond.....	200
Lake Blanche.....	1,200	Morven, Eddins's pond.....	200
Rolla, North Spring Creek.....	800	Gatlings's pond.....	200
Sedalia, Kahn's pond.....	200	Gray Pond.....	200
Norton's pond.....	2,000	Mount Airy, Brower's pond.....	400
Slater, Rhoades's pond.....	200	Mount Olive, Williams's mill pond.....	400
Speed, Ingleside Pond.....	300	Newells, Timmon's pond.....	100
Valley Park, Wilson Lake.....	1,600	Oakboro, Mason Branch Pond.....	200
Verona, Spring River.....	2,500	Parkton, Campbell Pond.....	400
New Jersey:		Pee Dee, Blewett Falls Pond.....	400
Boonton, Towasco Lake.....	200	Raleigh, Bartholomew's pond.....	200
Old Bridge, Laurel Pond.....	250	King's pond.....	200
New Mexico:		Kitchin's pond.....	200
Alamillo, San Acacia Lake.....	200	Milburnie Pond.....	300
Chamita, Rio Grande.....	150	Neusecoo Pond.....	200
Clayton, Perico Creek.....	200	Panther Pond.....	200
Deming, Idyl-Wyld Pond.....	100	Roaring River, Byrd's pond.....	150
Elida, McAlester's pond.....	50	Rockingham, Falling Creek.....	300
Mullen's pond.....	50	Watery Branch Pond.....	200
Phillips's pond.....	50	Roseboro, Crumpler's pond.....	400
Estancia, Barnhart's pond.....	100	Sanford, Old Still Creek.....	100
Williams Lake.....	100	Scotland Neck, Josey's pond.....	450
Kenna, Kimo Pond.....	50	Severn, Blackwater Pond.....	175



*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
North Carolina—Continued.		Oklahoma—Continued.	
Wadesboro, Huntley's pond.....	200	Oakman, Wilborn's pond.....	200
Wake Forest, Bailey's pond.....	200	Oakwood, Bermuda Lake.....	100
Brewer's pond.....	200	Orlando, Twin Oak Pond.....	200
Powell's pond.....	150	Pauls Valley, Driskill's pond.....	100
Rocky Branch.....	200	Thompson's lake.....	200
Wall's pond.....	200	Perry, Pagel's pond.....	200
Weldon, Club Pond.....	250	Perry Lake.....	200
Williamston, Little Conoho Creek.....	650	Waltermire's pond.....	200
Wilmington, Quarry Lake.....	600	Rocky, Bowman's pond.....	200
Wilson, Farmers Mill Pond.....	500	Seminole, Quimby's pond.....	200
Winston Salem, Livingood's pond.....	300	Sparks, Fairview Pond.....	200
Woodleaf, Alexander Pond.....	150	Stillwater, Ahrberg's pond.....	200
Youngsville, Clifton's pond.....	450	Callison's pond.....	200
Moore's pond.....	300	Parker's pond.....	200
North Dakota:		Stratford, Agnew Pond.....	100
Devils Lake, Devils Lake.....	1,000	McAlister's pond.....	100
Lisbon, Sheyenne River.....	800	Stroud, Silver Pond.....	200
Ohio:		Texhoma, Allison's pond.....	200
Akron, Long Lake.....	450	Texola, Graves's pond.....	200
Nesmith Lake.....	450	Walter, Eder's pond.....	100
New Lake.....	450	Wapanucka, Darter's pond.....	200
Turkeyfoot Lake.....	300	Watova, Munson's pond.....	100
West Lake.....	450	Weatherford, Cobb Creek.....	100
Athens, Burson's pond.....	200	Wellston, Lyon's pond.....	200
Bellville, Gatton's pond.....	100	McKinney Pond.....	200
Berea, Brown's pond.....	300	Wynnewood, Willow Spring Pond.....	100
Cambridge, City Lake.....	300	Pennsylvania:	
Tin Mill Pond.....	100	Butler, Conoquenessing Creek.....	350
Canton, Foster's ponds.....	300	Muddy Creek.....	350
Carey, Club Pond.....	150	Christiana, Octoraro Creek.....	600
Chillicothe, Paint Creek.....	400	Claysburg, Juniata River, Beaver-	
Cleves, Morgan's pond.....	200	dam Branch.....	250
Covington, Panther Creek.....	400	Curry, Keagy Pond.....	375
Crestline, Sandusky River.....	450	Denver, Swamp Creek.....	200
Creston, Evergreen Pond.....	150	Eagles Mere, Eagles Mere Lake.....	600
Lima, McCullough Lake.....	150	Falls, Lake Winola.....	600
Loveland, Schemel's pond.....	200	Gap, Pequea Creek.....	600
Mentor, Spring Pond.....	150	Lancaster, City Mill Pond.....	600
Millersburg, Rottman Park Lake.....	200	Isaiah Weavers Pond.....	600
Newark, Buckeye Lake.....	600	Martin's pond.....	600
Licking River.....	600	Mill Creek.....	250
New Bavaria, Kammerer's pond.....	150	Nult's pond.....	600
North Baltimore, Demming Quarry		Rocky Spring Pond.....	600
Pond.....	150	Sensenig Pond.....	600
North Randall, Warner's pond.....	150	Landenburg, White Clay Creek.....	400
Oak Harbor, Portage River.....	150	Langhorne, Neshaminy Creek.....	400
Plymouth, Quarry Lake.....	300	Lititz, Hubers Pond.....	70
St. Marys, Lake St. Marys.....	600	Newtown, Neshaminy Creek.....	400
Strongsville, Deer Lick Pond.....	150	Philadelphia, League Island Pond.....	500
Wickliffe, Neale's pond.....	150	Phoenixville, French Creek.....	600
Oklahoma:		Schuylkill River.....	600
Ada, Lewis's pond.....	200	Pocono Summit, Tunkhannock	
Ardmore, Boucher's pond.....	100	Creek.....	200
Club Lakes.....	800	Reading, Beaver Creek.....	231
Armstrong, Hatchery Ponds.....	90	Socany Creek.....	210
Blocker, Delorvin's pond.....	100	Rushland, Neshaminy Creek.....	400
Bristow, Edgewood Pond.....	200	Safe Harbor, Hess Run.....	276
Morgan's pond.....	200	Savan, Mud Lick Run.....	250
Byars, Lake Catron.....	200	Scranton, Moosic Lake.....	600
Town Lake.....	100	West Willow, Pequea Creek.....	200
Carney, Roberts's pond.....	200	Wilkes-Barre, Thorn Lake.....	400
Chickasha, Club Lake.....	200	South Carolina:	
Coleman, Wood Lake.....	100	Aiken, Redcliffe Pond.....	600
Cordell, Bonham's pond.....	200	Baldoc, Doe Pond.....	1,400
Custer City, Schneider's pond.....	200	Bethune, Mangum's pond.....	200
Earlboro, Spinks's pond.....	200	Munn's pond.....	400
Edmond, Keefer's pond.....	200	Blythewood, Wilson's pond.....	600
Erick, Everett's pond.....	200	Central, Arnold's pond.....	200
Featherston, Prairie Lake.....	200	Clio, Everett Mill Pond.....	200
Forgan, Lawson's pond.....	100	Columbia, Brown's pond.....	600
Konawha, Cook's pond.....	200	Cobb's pond.....	800
Flag Lake.....	200	Dent's pond.....	800
Townsend's pond.....	200	Padgett Pond.....	800
Maramec, Pattison Pond.....	200	Reedy's pond.....	600
Milburn, Rhea's pond.....	200	Snow Hill Pond.....	200
Minco, Sherer Spring Lake.....	200	Conway, Cypress Pond.....	400
Mounds, Barton's lake.....	200	Creston, Holman's pond.....	400
Muskogee, City Park Lake.....	100	Darlington, Broadmoor Pond.....	400
Noble, Lake Dunaway.....	200	Crescent Lake.....	400
Nowata, Tillotson's pond.....	200		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
South Carolina—Continued.		Tennessee:	
Dalzell, Haynsworth Pond.....	400	Bolivar, Hazlegrove's pond.....	50
Denmark, Lake Lorraine.....	600	Brace, Buffalo Pond.....	150
Easley, Adkin's pond.....	400	Brownsville, Cobb's pond.....	80
Alice Mills Ponds.....	400	Collinswood, Cole's pond.....	150
Glenwood Lakes.....	400	Harriman, Browder's pond.....	200
Hendrix's pond.....	200	Heiskell, Gadson's pond.....	100
Edgefield, May's pond.....	200	Jacksboro, Queener's pond.....	200
Gaffney, Hamrick's pond.....	200	McMinnville, Mountain Creek.....	80
Wood's pond.....	200	Maryville, Tucker Pond.....	235
Gaston, Giugnard's pond.....	600	Memphis, Arnold's lake.....	240
Greelyville, Lesesue's pond.....	400	Mont Eagle, Gregory's pond.....	100
Greenville, Harris's pond.....	200	Quebeck, Chaneller's pond.....	200
Hunts Pond.....	400	White, Walnut Grove Pond.....	50
Kelly's pond.....	200	Texas:	
Mill Pond.....	400	Abernathy, Henderson Pond.....	100
Reedy River.....	400	Athens, Deupree's pond.....	150
Greenwood, Panola Pond.....	200	Atlanta, Baucum's pond.....	200
Hampton, Rentz's pond.....	400	Cameron's pond.....	200
Hodges, Gantt's pond.....	200	Chamblee's pond.....	200
Johnston, Edisto Pond.....	2,000	Henry's pond.....	200
Nancy Lake.....	2,000	Long Pond.....	200
Yonce's pond.....	1,500	White's pond.....	200
Langley, Clearwater Power House		Baird, Highland Lake.....	100
Pond.....	800	Tatum's pond.....	100
Leesville, Clearwater Pond.....	200	Terrell's pond.....	100
Summerland Farm Pond.....	200	Belton, Leon River.....	300
Lexington, Roof's pond.....	200	Boerne, Menger Creek Pond.....	300
Liberty, Gantt's pond.....	200	Bonham, Johns Estell Repose Lake.....	50
Lykesland, Rawlinson's pond.....	300	Stager's pond.....	50
McBee, Cedar Creek Pond.....	400	Brady, Bengstrom's pond.....	100
Hannah Pond.....	400	Henderson's pond.....	100
Middleton's pond.....	400	Wooten's pond.....	100
Marion, Little Pee Dee River.....	800	Brownwood, Arczie's pond.....	250
Minturn, McQueen's pond.....	400	Burleson, Overton's pond.....	200
Mount Croghan, Wilson's pond.....	200	Burton, Fusch's pond.....	150
Neeses, Bonin's pond.....	500	Caldwell, Haddox's pond.....	150
Fogle's pond.....	500	Chapel Hill, Caney Creek.....	400
Newberry, Johnston's pond.....	200	Christine, Barber's pond.....	200
Smith's pond.....	200	Barker's ponds.....	300
North, Salem Pond.....	1,000	Clarksville, Sherry Pond.....	650
Orangeburg, Caw Caw Creek.....	1,000	Coleman, Crockett's pond.....	250
Caw Caw Pond.....	300	Cooper, Lake Geneva.....	150
Dukes's pond.....	300	Crockett, Berry's lake.....	200
Fishery Branch.....	1,500	Smith's lake.....	200
Jennings's pond.....	600	Crosbyton, Miller's pond.....	100
Salley's pond.....	500	Dallas, Country Club Lake.....	400
Pelion, Lucas's pond.....	400	Edgewood, Jones's pond.....	100
Pomaria, Bedenbaugh's pond.....	200	Elgin, Johnson's pond.....	200
Richburg, Fishing Creek.....	600	Elkhart, Howell Lake.....	150
Richland, Verner's pond.....	200	Enloe, Petitfil's pond.....	100
St. Matthews, Millwood Pond.....	400	Fredericksburg, Kneese's pond.....	100
Salley, Haltiowanger's pond.....	1,200	Giddings, Berger's pond.....	200
Seneca, Langston's pond.....	200	Fischer's pond.....	200
Maple Pond.....	200	Gilmer, Blue Lake.....	250
Simpsonville, Garrett's pond.....	200	Carey Lake.....	250
Richardson's pond.....	200	Mattox Pond.....	100
Society Hill, Evans Mill Pond.....	400	Phillips Lake.....	250
Spartanburg, Chapman's pond.....	400	Silver Lake.....	300
Poole's pond.....	400	Warren's pond.....	250
Sumter, Pocalla Lake.....	600	Graford, Humphre-Halsel Pond.....	100
Privateer Pond.....	400	Grand Saline, Clarke's pond.....	100
Whilden's pond.....	800	Crawford's lake.....	150
Summerville, Schultz Lake.....	400	Germany Lake.....	150
Taylors, Bridwell's pond.....	200	Harper Lake.....	150
Trenton, Crouch's pond.....	800	Grapeland, Gaines's pond.....	150
Miller's pond.....	1,200	Harrisburg, Plum Creek.....	300
White Oak, Adger Pond.....	200	Henderson, Bennett's pond.....	200
Wimmsboro, Moore's pond.....	230	Strong's pond.....	200
Willford Lakes.....	200	Hubbard, Waterworks Lake.....	250
South Dakota:		Jacksboro, Gaskin's pond.....	100
Belvidere, Belvidere Lake.....	800	Graves's pond.....	300
Canton, Sioux River.....	300	Jacksonville, Goodson's lake.....	400
Clear Lake, Clear Lake.....	600	Hogan's lake.....	600
Lake Andes, Lake Andes.....	1,400	Kilgore, Nolen's pond.....	100
Lemmon, Haltzel's pond.....	200	Littlefield, McClevey-Ely Pond.....	100
Madison, Lake Madison.....	1,400	Longview, Clear Lake.....	400
Pukwana, Red Lake.....	1,400	T. & P. Lake.....	300
Timber Lake, Simonson's pond.....	200		

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## SUNFISH—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Texas—Continued.</b>		<b>Virginia—Continued.</b>	
Lubbock, Fair Acres Pond.....	200	Evergreen, Glover's pond.....	20
Loyd's pond.....	100	Ferrum, Brogan's pond.....	100
Potts's pond.....	100	Fort Mitchell, Watson's pond.....	20
Barber's pond.....	300	Lawyers, Flat Creek.....	20
Scroggin's pond.....	100	Lynchburg, McGehee's pond.....	100
Lyons, Ruback's pond.....	100	McKinney, Long Pond.....	100
Manor, Eppright's pond.....	200	Pamplin, Driskill's pond.....	20
Marfa, San Jacinto Pond.....	150	Richmond, City Lakes.....	20
Webb Pond.....	150	Lakeside Lake.....	40
Marshall, Martin's lake.....	300	Spout Springs, Robertson's pond.....	20
Woodland Lake.....	200	Suffolk, Brewer's pond.....	300
Midland, Cloverdale Pond.....	100	Lake George.....	300
Minola, Beaupre's pond.....	150	Sycamore, Owen-Hunt Pond.....	100
Blue Lake.....	200	Plains, Goose Creek.....	80
Clanton Pond.....	300	Huntland Pond.....	40
Concord Pond.....	100	Ice Pond.....	100
Conger's pond.....	200	Waverly, Clark Mill Pond.....	400
Huff Lake.....	300	West Virginia:	
Mineral Wells, Turkey Creek.....	250	Coleman, Thompson's pond.....	200
Monahans, Bullock Pond.....	100	White Sulphur Springs, Howard	
Jones Pond.....	100	Creek.....	100
Ranch Pond.....	100	Wisconsin:	
Woods Pond.....	100	Alma, Waumandee Mill Pond.....	600
Mount Calm, Davis's pond.....	150	Beaver Dam, Beaverdam Lake.....	1,100
Muleshoe, Bledsoe's pond.....	100	Blair, Trempealeau Pond.....	1,000
Novice, Clear Pond.....	200	Deer Park, South Fish Lake.....	400
Paige, Koslan's pond.....	150	Eland, Lake Go-To-It.....	1,000
Palestine, Broughton's lake.....	300	Fountain City, Mississippi River.....	a 84,445
Crystal Lake.....	700	Frederic, Diamond Lake.....	600
Sand Lake.....	200	Genoa, Mississippi River.....	a 75,000
Spring Park Lake.....	250	La Crosse, Bank Slough Creek.....	1,000
Pearsall, Elm Pen Pond.....	100	Brown's Marsh Lake.....	1,000
Indian Hill Pond.....	100	Coleman Slough Creek.....	1,000
Maney's pond.....	100	Crooked Slough Creek.....	1,000
Plainview, Saigheig's pond.....	150	French Lake.....	1,000
Ravenna, Cunningham's pond.....	195	Holman Mill Pond.....	1,000
Grogan's pond.....	165	Maxs Lake.....	1,000
Rockdale, Blue Pond.....	200	Mississippi River.....	a 175,000
Praesel's pond.....	200	Round Lake.....	1,000
Rugby, Griffin Lake.....	250	Twin Lakes.....	1,000
Spooford, Jones's pond.....	100	West Salem Mill Pond.....	1,000
Tahoka, Wood's pond.....	100	La Farge, Kickapoo River.....	1,000
Taylor, Burkmann's pond.....	200	La Farge Mill Pond.....	750
Inland Lake.....	150	Rockton Mill Pond.....	750
Temple, Lily Pond.....	100	Lynxville, Mississippi River.....	a 20,000
Terrell, Bond's pond.....	300	Prairie du Sac, Berges Lake.....	800
Tyler, Chinquapin Lake.....	300	Kruger Pond.....	500
Hitts Mill Pond.....	300	Lodi Creek.....	500
Welfare, Joshua Creek.....	200	Swanson Lake.....	800
Winchell, Duncan's pond.....	162	Stanley, Eau Claire River, North Fork	
Virginia:		Trempealeau, Mississippi River.....	a 158,125
Beaver Dam, Sunny Pond.....	100	West Frairie Mill Pond.....	1,000
Benhams, Sproles's pond.....	100	Viroqua, Mapledale Pond.....	1,400
Charlottesville, Lyons Pond.....	20	Wyocena, Tiger Mill Pond.....	400
Colburn, Silver Lake.....	100	Canal Zone: Ancon, Panama Canal.....	800
Drakes Branch, Dalton's pond.....	20		
East Lexington, North River.....	500	Total b.....	2,670,513

## PIKE PERCH.

Arkansas: Black Rock, Black River...	83	Indiana—Continued.	
Illinois:		Logansport, Fletcher Lake.....	†200,000
Carlinville, Macoupin Creek.....	†200,000	Pleasant Lake, Pleasant Lake.....	†200,000
Dallas City, Lake Cooper.....	11	Warsaw, Tippecanoe Lake.....	†500,000
Kankakee, Kankakee River.....	†200,000	Iowa:	
Meredosa, Meredosa Bay.....	†50,000	Fairport, Mississippi River.....	606
Napierville, Du Page River, West		Spirit Lake, State fish commission..	*40,000,000
Branch.....	†250,000	Kentucky:	
Spring Grove, State fish commission.	*15,000,000	Altro, Kentucky River, North Fork	†100,000
Wilmington, Kankakee River.....	†250,000	Athol, Kentucky River, Middle Fork	†200,000
Indiana:		Bowling Green, Barren River.....	†1,300,000
Culver, Lake Maxinkuckee.....	†300,000	Chavies, Kentucky River, North	
Edinburg, Sugar Creek.....	†300,000	Fork.....	†100,000
Indianapolis, State fish commis-		Cornettsville, Kentucky River,	
sion.....	*17,000,000	North Fork.....	†300,000

a Rescued from overflowed lands and returned to original waters.

b Lost in transit, 8,400 fingerlings.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## PIKE PERCH—Continued.

Disposition.	Number.	Disposition.	Number.
Kentucky—Continued.		Nebraska: Gretna, State fish commission.....	*9,800,000
Glomawr, Kentucky River, North Fork.....	†200,000	New York:	
Haddix, Kentucky River, North Fork.....	†100,000	Cape Vincent, St. Lawrence River.....	†500,000
Hazzard, Kentucky River, North Fork.....	†100,000	State fish commission.....	†6,600,000
Jackson, Kentucky River, North Fork.....	†100,000	Evans Mills, Indian River.....	†450,000
Johnsonville, Kentucky River, Middle Fork.....	†300,000	Hamilton, Leland Pond.....	†300,000
Livingston, Rockcastle River.....	†500,000	Madison Lake.....	†150,000
Louisville, Ohio River.....	†2,000,000	Newark, Coffey Lake.....	†400,000
Mount Vernon, Renfroy Creek.....	†400,000	Niagara Falls, Niagara River, Lower	†600,000
O. & K. Junction, Kentucky River, North Fork.....	†300,000	Potsdam, Rackett River.....	†600,000
Peoples, Rockcastle River.....	†400,000	Schnevus, Schnevus Lake.....	†225,000
Viper, Kentucky River, North Fork.....	†100,000	Shohola, Montgomery Lake.....	†200,000
Ward, Big Sandy River.....	†400,000	Washington Lake.....	†200,000
Whick, Kentucky River, North Fork.....	†200,000	Wurtsboro, Masters Lake.....	†150,000
Wolf Coal, Kentucky River, North Fork.....	†200,000	North Dakota:	
Yerkes, Kentucky River, North Fork.....	†100,000	Devils Lake, Devils Lake.....	*3,000,000
Maine: Orono, Pushaw Lake.....	†500,000	St. John, State fish commission.....	*3,000,000
Michigan:		Ohio:	
Alpena, Long Lake.....	†750,000	Antwerp, Maumee River.....	†300,000
Thunder Bay River.....	†400,000	Catawba Island, Lake Erie.....	†10,000,000
Bay City, Saginaw Bay.....	†2,400,000	Cecil, Maumee River.....	†200,000
Belle Isle Park, Detroit River.....	†400,000	Columbus, Scioto River.....	†300,000
Bergland, Lake Gogebic.....	†112,500	Defiance, Maumee River.....	†200,000
Channing, Sawyer Lake.....	†75,000	Isle St. George, Lake Erie.....	†20,000,000
Cheboygan, Lake Huron.....	†2,400,000	Kelleys Island, Lake Erie.....	†10,000,000
Clare, Stephenson Lake.....	†250,000	Lake View, Indian Lake.....	†500,000
Crystal Falls, Dollar Lake.....	†37,500	Middle Bass, Lake Erie.....	†26,000,000
Fortune Lake.....	†37,500	Napoleon, Maumee River.....	†300,000
Michigamme River, Lower Paint River.....	†75,000	Oakwood, Auglaize River.....	†300,000
Detroit, State fish commission.....	*40,500,000	Port Clinton, Lake Erie.....	†15,000,000
Escanaba, Lake Florence.....	†37,500	Put in Bay, Lake Erie.....	†30,000,000
Guinn, Johnson Lake.....	†37,500	State fish commission.....	*73,600,000
Shag Lake.....	†37,500	Pennsylvania:	
Highland, Dunman Lake.....	†500,000	Bryn Mawr, Earle Lake.....	†100,000
Whalen Lake.....	†400,000	Clarks Summit, Chinchilla Pond.....	†100,000
Iron Mountain, Browning Lake.....	†37,500	Ford Lake.....	†100,000
Iron River, Lake No. 9.....	†37,500	Gravel Pond.....	†100,000
Lake No. 16.....	†37,500	Mill Pond.....	†100,000
Michigamme River, Middle Fork.....	†75,000	Erie, State fish commission.....	*2,000,000
Stanley Lake.....	†75,000	Franklin, Allegheny River.....	†400,000
Sunset Lake.....	†37,500	French Creek.....	†300,000
Twenty Eight Lake.....	†37,500	Sugar Creek.....	†200,000
Little Lake, Godin Lake.....	†112,500	Hosensack, Hosensack Creek.....	†150,000
Mandan, Lake Bailly.....	†37,500	Johnstown, Dubstalts Dam.....	†100,000
Mandora Lake.....	†37,500	Hinckston Pond.....	†100,000
Schlautters Lake.....	†37,500	Quemahoning Pond.....	†100,000
Marquette, Pellisur Lake.....	†75,000	Stony Creek.....	†100,000
Strawberry Lake.....	†75,000	Lancaster, Enos Weaver Pond.....	†40,000
Michigamme, Perch Lake.....	†37,500	Hinkletown Pond.....	†40,000
Phoenix, Gratiot Lake.....	†75,000	Hirst Pond.....	†40,000
Pickford, Monoskong Bay.....	†2,000,000	Hoover Pond.....	†40,000
St. Marys Junction, Franklin Pond.....	†37,500	Zooks Pond.....	†40,000
South Range, Otter Lake.....	†112,500	Lebanon, Greenville Pond.....	†83,334
Twin Lakes, Johnson Lake.....	†37,500	Stoever Mill Pond.....	†83,333
Wellington, Kallander Pond.....	†37,500	Weidman Pond.....	†83,333
Witbeck, Bullhead Lake.....	†225,000	Millford, Mud Pond.....	†100,000
Wooster, Crystal Lake.....	†250,000	Pleasant Mount, State fish commission.....	*2,000,000
Minnesota:		Torresdale, State fish commission.....	*2,000,000
Atwater, Summit Lake.....	†200,000	Union City, State fish commission.....	*2,000,000
Barnum, Big Lake.....	†75,000	Rhode Island: Providence, Wallum Lake.....	†400,000
Central Lakes, August Lake.....	†50,000	South Dakota: Watertown, State fish commission.....	*3,000,000
Homer, Mississippi River.....	a 1,825	Tennessee: Sevierville, Little Pigeon River.....	†400,000
Lake City, Lake Pepin.....	a 59	Vermont:	
Switch 406, Pike Lake.....	†112,500	Brandon, Burr Pond.....	†100,000
Waseca, Clear Lake.....	†200,000	Hinkum Pond.....	†100,000
Missouri:		Lake Hortonia.....	†300,000
Newburg, Lower Piney Creek.....	†200,000	Brattleboro, Lake Raponda.....	†200,000
Wappapello St. Francis River.....	†250,000	Newbury, Harriman Pond.....	†100,000
		North Ferrisburg, Cedar Lake.....	†100,000
		Swanton, Missisquoi River.....	†9,800,000
		Wells River, Halls Pond.....	†200,000
		West Virginia:	
		Charleston, Kanawha River.....	†500,000
		Huntington, Ohio River.....	†500,000

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## PIKE PERCH—Continued.

Disposition.	Number.	Disposition.	Number.
<b>Wisconsin:</b>		<b>Wisconsin—Continued.</b>	
Amburg, Glen Lake.....	+75,000	Menomonie, Cut Off Lake.....	+50,000
Bangor, La Crosse River.....	+200,000	Dunnville Lake.....	+50,000
Beaver Dam, Crystal Lake.....	+200,000	Downsville Lake.....	+50,000
Boyd, Eau Claire River.....	+250,000	Hunts Lake.....	+50,000
Otter Creek.....	+150,000	Manley Bend Lake.....	+50,000
Pike Lake.....	+150,000	New Haven Lake.....	+50,000
Cedarburg, Milwaukee River.....	+150,000	Red Cedar River.....	+100,000
Centuria, Popular Lake.....	+187,500	Sand Lake.....	+50,000
Chippewa Falls, Long Lake.....	+400,000	Yellow Banks Lake.....	+50,000
Yellow River.....	+300,000	Mercer, Sugar Camp Lake.....	+75,000
Crandon, Big Sand Lake.....	+37,500	Nashville, Rice Lake.....	+75,000
Clear Lake.....	+37,500	New Richmond, Cedar Lake.....	+200,000
Metonga Lake.....	+22,500	Pelican, Pelican Lake.....	+75,000
Sand Lake.....	+37,500	Pembine, Headquarters Lake.....	+75,000
Stone Lake.....	+37,500	Readstown, Kickapoo River.....	+250,000
Devils Lake, Devils Lake.....	+200,000	Kickapoo River, East Branch.....	+150,000
Eldorado, Eldorado Pond.....	+150,000	Reedsburg, Baraboo River.....	+200,000
Woolen Mill Creek.....	+150,000	Russell Creek.....	+150,000
Fountain City, Mississippi River.....	a 790	Rice Lake, Ginder Lake.....	+50,000
Genoa, Mississippi River.....	a 4,000	Hemlock Lake.....	+75,000
Gordon, Bond Lake.....	+75,000	Rice Lake.....	+100,000
Grand Rapids, Fourteen Mile Creek.....	+150,000	Upper Deety Lake.....	+50,000
Wisconsin River.....	+200,000	Upper Rice Lake.....	+50,000
Hawthorne, Lyman Lake.....	+100,000	Sheboygan Falls, Gerber Lake.....	+150,000
Hayward, Elmer Lake.....	+75,000	Prairie Lake.....	+150,000
Hagan Lake.....	+75,000	Stanley, Jump River.....	+250,000
Holly Lake.....	+75,000	Stone Lake, Bass Lake.....	+50,000
Murphy Lake.....	+75,000	Flat Lake.....	+75,000
Star Lake.....	+75,000	Slim Lake.....	+100,000
Independence, Bugle Lake.....	+175,000	Superior, Amnicon Lake.....	+100,000
Iron River, Upper Eau Claire Lake.....	+100,000	Tomahawk, Big Rice Lake.....	+50,000
Kilbourn, Wisconsin River.....	+200,000	Big Rice River.....	+100,000
La Crosse, Bank Creek.....	+50,000	Clear Lake.....	+200,000
Black River.....	+100,000	Crystal Lake.....	+200,000
Black Snake Creek.....	+50,000	Deer Lake.....	+50,000
Broken Gun Creek.....	+50,000	Lake Clara.....	+50,000
Browns Marsh Bay.....	+50,000	Little Rice River.....	+100,000
Chamberlain Creek.....	+50,000	Long Lake.....	+100,000
Clark Lake.....	+50,000	Manson Lake.....	+100,000
Dark Creek.....	+50,000	Muscallonge Lake.....	+50,000
Dodge Chute Creek.....	+50,000	Mystic Lake.....	+50,000
Dutch Creek.....	+50,000	Road Lake.....	+50,000
French Creek.....	+50,000	Skanawan Lake.....	+50,000
Hammond Chute Creek.....	+50,000	Somo Lake.....	+100,000
Jolliette Bay.....	+50,000	Somo River.....	+150,000
Mississippi River.....	a 3,500	Spirit Lake.....	+100,000
Rice Lake.....	+50,000	Spirit River.....	+100,000
Running Creek.....	+50,000	Tomahawk River.....	+300,000
Spring Creek.....	+50,000	Wisconsin River.....	+100,000
Swift Creek.....	+50,000	Waupaca, Clear Lake.....	+175,000
Wigwam Creek.....	+50,000	Stratton Lake.....	+150,000
Lakeside, Pewaukee Lake.....	+250,000	Winter, Barber Creek.....	+50,000
Laona, Buck Lake.....	+75,000	Barber Lake.....	+100,000
Silver Lake.....	+75,000	Barker Lake.....	+50,000
Lynxville, Mississippi River.....	a 5,000	Black Dan Lake.....	+50,000
Mellen, Carroll Lake.....	+50,000	Brunette River.....	+175,000
Lake Galilee.....	+75,000	Fly Bow Creek.....	+75,000
Menomonie, Asylum Bend Lake.....	+50,000	Island Lake.....	+75,000
Atlata Lake.....	+50,000		
Bear Lake.....	+50,000		
Black Lake.....	+50,000		
Chippewa River.....	+100,000		
Colfax Lake.....	+50,000		
		Total b.....	*212,900,000 +174,097,500 15,874

## YELLOW PERCH.

<b>Colorado:</b>		<b>Illinois—Continued.</b>	
Wray, McGee's pond.....	300	Galena, Mississippi River.....	a 3,700
Matheny Lake.....	300	Galesburg, City Lake.....	30
<b>Connecticut:</b>		Millington, Fox River.....	30
Hartford, Buckland's pond.....	+150,000	Nora, Apple River.....	50
Waterbury, Pritchard Pond.....	300	Red Bud, Parrott Pond.....	75
<b>Illinois:</b>		Warren, Apple River.....	200
Dallas City, Lake Cooper.....	47	Indiana: Columbus, White River,	
Farmer City, Salt Creek.....	30	East Branch.....	60

a Rescued from overflowed lands and restored to original waters.

b Loss in transit, 415,000 fry.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## YELLOW PERCH—Continued.

Disposition.	Number.	Disposition.	Number.
Iowa:		New York—Continued.	
Belleue, Mississippi River.....	a 825	Mount Marion, Birch Pond.....	†150,000
Fairfield, Fairfield Pond.....	300	Narrowsburg, Lake Narrowsburg.....	†600,000
Fairport, Mississippi River.....	a 305	Ogdensburg, State fish commission..	†250,000
Lime Springs, Upper Iowa River.....	450	Pine Bush, Dwaarkill Creek.....	†300,000
Manchester, Maquoketa River.....	500	Poplar Tree Bay, St. Lawrence	
North McGregor, Mississippi River.....	a 10,500	River.....	†4,400,000
Kansas: Fort Scott, Bridal Veil Lake.....	†20,000	Port Henry, Ledge Lake.....	
Kentucky:		Rhinecliffe, Crystal Lake.....	†450,000
Louisville, Lansdowne Lake.....	30	Ellerslie Lake.....	†600,000
Maceo, Kingfisher Lake.....	120	Scotch Brook, St. Lawrence River..	†750,000
Mount Sterling, Lewis Pond.....	30	North Carolina:	
Marshall's pond.....	30	Connelly Springs, Cannon Creek.....	54
Thompson's pond.....	30	Macon, Hardy Spring Pond.....	27
Tipton's pond.....	30	Pee Dee, Blewett Falls Lake.....	81
Massachusetts:		Rockingham, Pee Dee Pond.....	81
Accokeek Creek, Potomac River.....	†21,050,000	Wilson, Hinnant's pond.....	54
Broad Creek, Potomac River.....	†5,220,000	North Dakota: Devils Lake, Devils	
Pamunkey Creek, Potomac River.....	†4,850,000	Lake.....	500
Piscataway Creek, Potomac River.....	†26,180,000	Ohio: Russells Point, Indian Lake....	140
Seneca, Potomac River.....	a 1,385	Oklahoma:	
Swan Creek, Potomac River.....	†4,350,000	Armstrong, Hatchery Ponds.....	{ †125,000
Massachusetts:		Glenceo, Murphy Lake.....	100
Lee, Greenwater Pond.....	†300,000	Mehan, Birdseye Lake.....	100
Laurel Lake.....	†300,000	Williams's pond.....	100
Lower Goose Pond.....	†300,000	Meridian, Brooks's pond.....	100
Shaw Pond.....	†750,000	Norman, Day Lake.....	100
Stockbridge Pond.....	†300,000	Huls Lake.....	100
Lowell, Keys Pond.....	†300,000	Moody Lake.....	100
Long Pond.....	†300,000	Shives Lake.....	200
Mud Pond.....	†300,000	State Hospital Lake.....	100
Round Pond.....	†300,000	Steen Lake.....	100
Pittsfield, Richmond Pond.....	†450,000	Ralston, Thompson's pond.....	100
Michigan: Rose Center, Long Lake.....	90	Rock Island, Robinson Pond.....	†15,000
Minnesota:		Stillwater, Kernke's pond.....	100
Fairmont, Sisseton Lake.....	400	Park's pond (A).....	100
Homer, Mississippi River.....	{ †a 150,000	Park's pond (B).....	100
Lake City, Lake Pepin.....	a 4,485	Pennsylvania:	
Richmond, Mississippi River.....	a 4,970	Altoona, Juniata River.....	120
Winona, Mississippi River.....	a 7,350	Curry, Keagy Pond.....	100
Mississippi:		Haleeka, Cresson Pond.....	20
Aberdeen, Big Clear Creek.....	25	Philadelphia, League Island Pond.....	125
Bream Lake.....	25	Quakertown, Lu Lu Park Pond.....	60
Cipsy Creek.....	25	Vermont:	
Dahl's pond.....	25	Brandon, Lake Hortonia.....	†900,000
Jones's lake.....	25	Brattleboro, West River.....	†600,000
Jones's pond.....	25	East Fairfield, Metcalf Pond.....	†300,000
Park Lake.....	25	Ely, Lake Fairlee.....	†600,000
Smith Lake (A).....	25	Fair Haven, Little Pond.....	225
Smith Lake (B).....	25	Milton, Westford Pond.....	†200,000
West Creek.....	25	North Ferrisburg, Cedar Lake.....	†400,000
Willow Lake.....	25	Lewis Creek.....	†300,000
Moon, Moon Lake.....	100	Little Otter Creek.....	†300,000
Missouri:		Poultney, Lake St. Catherine.....	406
Ferguson, Wabash Club Lake.....	20	Rutland, Meadow Lake.....	†600,000
Joplin, Sloan Lake.....	{ †5,000	Otter Creek.....	200
Spring River.....	†15,000	St. Johnsbury, Gilman's Pond.....	†750,000
Kansas City, Alton-Slater Pond.....	273	Salisbury, Otter Creek.....	†500,000
Lisle, Lisle Lake.....	†20,000	Sharon, Moose Meadow Pond.....	†300,000
Merwin, Corbin's pond.....	200	South Londonderry, Lowell Lake.....	†750,000
Neosho, Haggard Pond.....	†1,000	Vernon, Lilly Pond.....	225
Morse Park Pond.....	400	Wells River, Hall's pond.....	†450,000
Sedalia, Kahn's pond.....	200	West Danville, Joes Pond.....	†600,000
New Hampshire:		Virginia:	
Concord, Contoocook River.....	†600,000	Dogue Creek, Potomac River.....	†28,350,000
Greenfield, Otter Lake.....	†450,000	Little Hunting Creek, Potomac	
Sunset Lake.....	†450,000	River.....	†15,460,000
Hanover, Cummings Pond.....	†300,000	Pohick Creek, Potomac River.....	†26,910,000
Manchester, Long Pond.....	†450,000	Wisconsin:	
Mosquito Pond.....	†450,000	Brokaw, Wisconsin River.....	1,050
New Jersey: Princeton, Carnegie Lake.....	180	Fountain City, Mississippi River.....	14,800
New York:		Galesville, Lake Marmuka.....	600
Barryville, Little Lake.....	†600,000	Genoa, Mississippi River.....	10,000
Cape Vincent, St. Lawrence River.....	†5,075,000	La Crosse, Mississippi River.....	20,000
Carleton Island, St. Lawrence River.....	50,000	Lynxville, Mississippi River.....	3,000
Fishkill, Brinckerhoff Pond.....	†1,050,000	Trempealeau, Mississippi River.....	19,320
Grassy Bay, St. Lawrence River.....	†15,775,000	Total.....	{ †175,421,000
Jamesport, Fleury's pond.....	†150,000		163,839

a Rescued from overflowed lands and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## WHITE PERCH.

Disposition.	Number.
North Carolina: Edenton, Albemarle Sound.....	†32,625,000

WHITE BASS. *a*

Disposition.	Number.	Disposition	Number.
Iowa:		Wisconsin:	
Bellevue, Mississippi River.....	4,500	Genoa, Mississippi River.....	300
Fairport, Mississippi River.....	498	La Crosse, Mississippi River.....	10,000
		Total.....	15,298

YELLOW BASS. *a*

Disposition.	Number.
Missouri: Ferguson, Wabash Club Lake.....	15

## STRIPED BASS.

North Carolina: Weldon, Roanoke River.....	†16,137,000
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## MACKEREL.

Disposition.	Number.	Disposition.	Number.
Massachusetts:		Massachusetts—Continued.	
Falmouth, Buzzards Bay.....	†789,000	Manchester, Massachusetts Bay.....	†420,000
Gloucester, Atlantic Ocean.....	†75,000		
Gosnold, Vineyard Sound.....	†1,057,000	Total.....	†2,341,000

## BUTTERFISH.

Disposition.	Number.
Massachusetts: Gloucester, Atlantic Ocean.....	†920,000

## COD.

Disposition.	Number.	Disposition.	Number.
Massachusetts:		Massachusetts—Continued.	
Beverly, Massachusetts Bay.....	†7,870,000	New Bedford, Buzzards Bay.....	†4,421,000
Chilmark, Vineyard Sound.....	†4,522,000	Rockport, Atlantic Ocean.....	†17,220,000
Falmouth, Buzzards Bay.....	†11,544,000	Tisbury, Nantucket Sound.....	†6,683,000
Eel Pond.....	†5,502,000	Vineyard Sound.....	†4,297,000
Great Harbor.....	†14,245,000	Woods Hole, Great Harbor.....	2,648
Nantucket Sound.....	†1,233,000	New York: New York City, Aquarium.....	*1,000,000
Vineyard Sound.....	†17,495,000		
Gloucester, Atlantic Ocean.....	†25,390,000		
Gosnold, Buzzards Bay.....	†2,458,000		
Great Harbor.....	†1,678,000	Total.....	*1,000,000
Vineyard Sound.....	†96,098,000		†236,786,000
Manchester, Massachusetts Bay.....	†16,130,000		2,648

*a* Rescued from overflowed land and restored to original waters.

*Distribution of fish and eggs, fiscal year 1917—Continued.*

## POLLOCK.

Disposition.	Number.	Disposition.	Number.
Maine: Boothbay Harbor, Boothbay Harbor.....	†3,346,000	Massachusetts—Continued.	
Massachusetts:		Manchester, Massachusetts Bay.....	†140,010,000
Beverly, Massachusetts Bay.....	†189,470,000	Marblehead, Massachusetts Bay.....	†14,620,000
Gloucester, Atlantic Ocean.....	†712,650,000	Rockport, Atlantic Ocean.....	†292,150,000
Ipswich Bay.....	†29,230,000	Ipswich Bay.....	†79,460,000
Massachusetts Bay.....	†13,160,000	Total.....	†1,474,096,000

## HADDOCK.

Massachusetts:		Massachusetts—Continued.	
Beverly, Massachusetts Bay.....	†800,000	Rockport, Ipswich Bay.....	†1,000,000
Gloucester, Atlantic Ocean.....	†4,920,000	Total.....	†6,720,000

## FLOUNDER.

Maine:		Massachusetts—Continued.	
Boothbay Harbor, Boothbay Harbor.....	†143,342,000	Gloucester, Ipswich Bay.....	†12,280,000
Linekins Bay.....	†662,230,000	Gosnold, Buzzards Bay.....	†16,794,000
East Boothbay, Linekins Bay.....	†77,257,000	Hadley Harbor.....	†111,148,000
Southport, Townsend Gut.....	†83,437,000	Lackeys Bay.....	†31,130,000
Massachusetts:		Vineyard Sound.....	†133,920,000
Chilmark, Menemsha Pond.....	†16,576,000	Manchester, Manchester Harbor.....	†14,180,000
Falmouth, Deacons Pond Harbor.....	†78,126,000	Massachusetts Bay.....	†14,300,000
Eel Pond.....	†14,083,000	Provincetown, Provincetown Harbor.....	†16,661,000
Great Harbor.....	†16,907,000	Wareham, Wareham River.....	†33,451,000
Nantucket Sound.....	†24,246,000	Rhode Island: Wickford, Wickford Harbor.....	†85,481,000
Waquoit Bay.....	†100,237,000	Total.....	†1,814,696,000
Gloucester, Annisquam River.....	†21,830,000		
Atlantic Ocean.....	†44,210,000		
Gloucester, Gloucester Harbor.....	†62,860,000		

MISCELLANEOUS FISHES.<sup>a</sup>

Arkansas: Black rock, Black River.....	1,922	Kentucky: Kuttawa, Cumberland River.....	1,041
Illinois: Dallas City, Lake Cooper.....	398	Minnesota: Lake City, Lake Pepin.....	9,027
Iowa: Fairport, Mississippi River.....	3,557	Total.....	15,945

## LOBSTER.

Maine:		Maine—Continued.	
Bass Harbor, Bass Harbor.....	†1,000,000	North Haven, North Haven Harbor.....	†1,500,000
Biddeford Pool, Biddeford Cove.....	†2,800,000	Orrs Isle, Chandlers Bay.....	†7,000,000
Bois Rubert, Pigeon Hill Bay.....	†1,500,000	Perkins, Oquiquit Harbor.....	†2,800,000
Boothbay Harbor, Boothbay Harbor.....	†500,000	Phippsburg, Small Point Harbor.....	†3,000,000
Linekins Bay.....	†5,000,000	Port Clyde, Port Clyde Harbor.....	†2,000,000
Cape Porpoise, Cape Porpoise.....	†3,000,000	Portland, Peaks Island Roads.....	†3,000,000
Cape Split, Cape Split Harbor.....	†3,500,000	Portland Harbor.....	†500,000
Pleasant Bay.....	†1,000,000	Rockland, Rockland Harbor.....	†6,000,000
Cundy Harbor, Cundy Harbor.....	†3,500,000	Rogue Bluff, Rogue Harbor.....	†3,000,000
Cushing, Georges River.....	†2,000,000	South Hancock, Penobscot Bay.....	†4,000,000
Pleasant Point Gut.....	†500,000	Skillings River.....	†6,000,000
Eastport, Broad Cove.....	†3,000,000	Southport, Ebencook Harbor.....	†5,000,000
Edgecomb, The Eddy.....	†5,000,000	Vinal Harbor, Crockett River.....	†2,000,000
Friendship, Friendship Harbor.....	†1,500,000	Westport, Clarks Cove.....	†5,000,000
Gouldsborough, Prospect Harbor.....	†2,000,000	York Harbor, York River.....	†2,800,000
Horse Isle, Horse Isle Harbor.....	†3,000,000	Massachusetts:	
Jonesport, Mooseapeak Reach.....	†4,000,000	Gloucester, Massachusetts Bay.....	†105,000
Kennebunkport, Kennebunkport Harbor.....	†3,000,000	Manchester, Massachusetts Bay.....	†155,000
Kittery, Pepperell Cove.....	†2,800,000	New Hampshire: Little Harbor, Little Harbor.....	†2,800,000
Machias, Starboard Creek.....	†3,000,000	Washington: Anacortes, Rosario Harbor.....	5,400
Mare Point, Mare Point Bay.....	†500,000	Total.....	†110,260,000
Mount Desert, Southwest Harbor.....	†1,000,000		5,400
New Harbor, New Harbor.....	†500,000		

<sup>a</sup> All enumerations listed in this statement represent miscellaneous fishes rescued from overflowed lands and restored to original waters.



## DISTRIBUTION COSTS.

In the latter part of 1915 a system was inaugurated by the superintendent of car and messenger service for determining the costs of distributing the various species of fishes. To furnish the office with the desired data, "cost slips" were attached to mileage reports, which messengers were required to submit to the office upon completion of each trip. The following table, based upon information contained in cost slips, shows the average cost per 1,000 of distributing fry, fingerling, and adult fishes for the calendar year 1916, exclusive of messengers' salaries:

## METHOD OF DISTRIBUTION, BY STATIONS, SPECIES, NUMBER, AND SIZE OF FISH, AND COSTS.

DISTRIBUTION BY CAR MESSENGERS.<sup>a</sup>

Name of station.	Species.	Number of fish.	Size.	Total cost.	Average cost per thousand.	Miles paid.	Miles free.
Bozeman, Mont.	Trout	586,000	Fry	\$187.80	\$0.32	1,806	
Do.	do.	132,600	Fingerlings, 1-inch	158.84	1.197	5,596	830
Do.	do.	37,100	Fingerlings, 2½-inch	174.15	4.69	2,013	
Craig Brook, Me.	do.	158,000	Fry	41.45	.262	1,008	
Do.	Salmon	30,000	do.	17.50	.583	43	
Green Lake, Me.	do.	135,000	do.	36.00	.266	616	
Do.	do.	63,000	Fingerlings, 1-inch	66.33	1.052	1,210	
Do.	Trout	60,800	Fry	21.40	.351	431	
Do.	do.	50,000	Fingerlings, 1-inch	16.23	.325	334	
Leadville, Colo.	do.	1,616,746	Fingerlings, 1-3 inch.	548.25	.339	2,634	15,843
Manchester, Iowa.	do.	420,360	Fingerlings, 1-4 inch.	425.56	1.01	7,243	
Northville, Mich.	do.	681,500	Fry	172.66	.2533	1,271	5,343
Do.	Pond fishes	75,427	Fingerlings, 1-2 inch.	537.95	7.13	10,742	72
Quincy, Ill.	do.	82,844	Fingerlings, 1-6 inch.	1,516.71	18.308	31,921	
Spearfish, S. Dak.	Trout	32,000	Fingerlings, 1-2½ inch	69.23	2.16	1,510	
Upper Mississippi collecting station. <sup>b</sup>	Pond fishes	139,711	Fingerlings, 1-6 inch.	1,457.48	10.432	27,475	442
Do.	do.	3,682	Adults	106.56	28.94	1,777	
White Sulphur, W. Va.	Trout	365,700	Fingerlings, 1-4 inch.	408.41	1.116	6,904	
Wytheville, Va.	do.	242,134	Fingerlings, 1-3 inch.	249.96	1.03	4,018	92

DISTRIBUTION BY STATION MESSENGERS.<sup>c</sup>

Baird, Cal.	Trout	14,000	Fry	\$64.10	\$4.578	1,403	
Do.	do.	20,000	Fingerlings, 1-inch	84.51	4.22	2,196	
Battery, Md.	Shad	400,000	Fry	5.70	.0142	68	
Do.	Yellow perch	64,100,000	do.	281.90	.00439	5,413	
Birdsview, Wash.	Trout	45,800	Fingerlings, 1-inch	91.25	1.99	2,016	
Bozeman, Mont.	do.	79,000	do.	84.50	1.069	1,162	
Do.	do.	263,200	Fingerlings, 1½-inch	160.10	.608	3,134	3,712
Do.	do.	29,500	Fingerlings, 2-inch	26.23	.889	615	
Do.	do.	3,400	Fingerlings, 2½-inch	12.65	3.72	137	
Do.	Grayling	118,000	Fry	12.65	.107		
Bullochville, Ga.	Pond fishes	209	Adults	131.98	631.48	3,145	
Do.	do.	359,684	Fingerlings, 1-5 inch.	1,459.59	4.057	32,311	4
Cape Vincent, N. Y.	Whitefish	11,900,000	Fry	108.22	.009	2,278	
Do.	Pike perch	10,790,000	do.	128.18	.0118	2,530	
Do.	Trout	926,000	do.	367.77	.397	8,426	31
Do.	do.	9,000	Fingerlings, 1-inch	13.12	1.46	560	
Do.	Salmon	7,000	Fry	9.92	1.417		
Clackamas, Oreg.	Trout	127,000	Fingerlings, 2½-inch	126.45	.995	2,544	50

<sup>a</sup> Detached messenger shipments from cars. Cost in addition to "Distribution by car."

<sup>b</sup> La Crosse, Bellevue, and North McGregors.

<sup>c</sup> Distribution by station messengers includes cost of making distribution direct from the station without a car. This distribution is usually to near-by points.

METHOD OF DISTRIBUTION, BY STATIONS, SPECIES, NUMBER, AND SIZE OF FISH,  
AND COSTS—Continued.

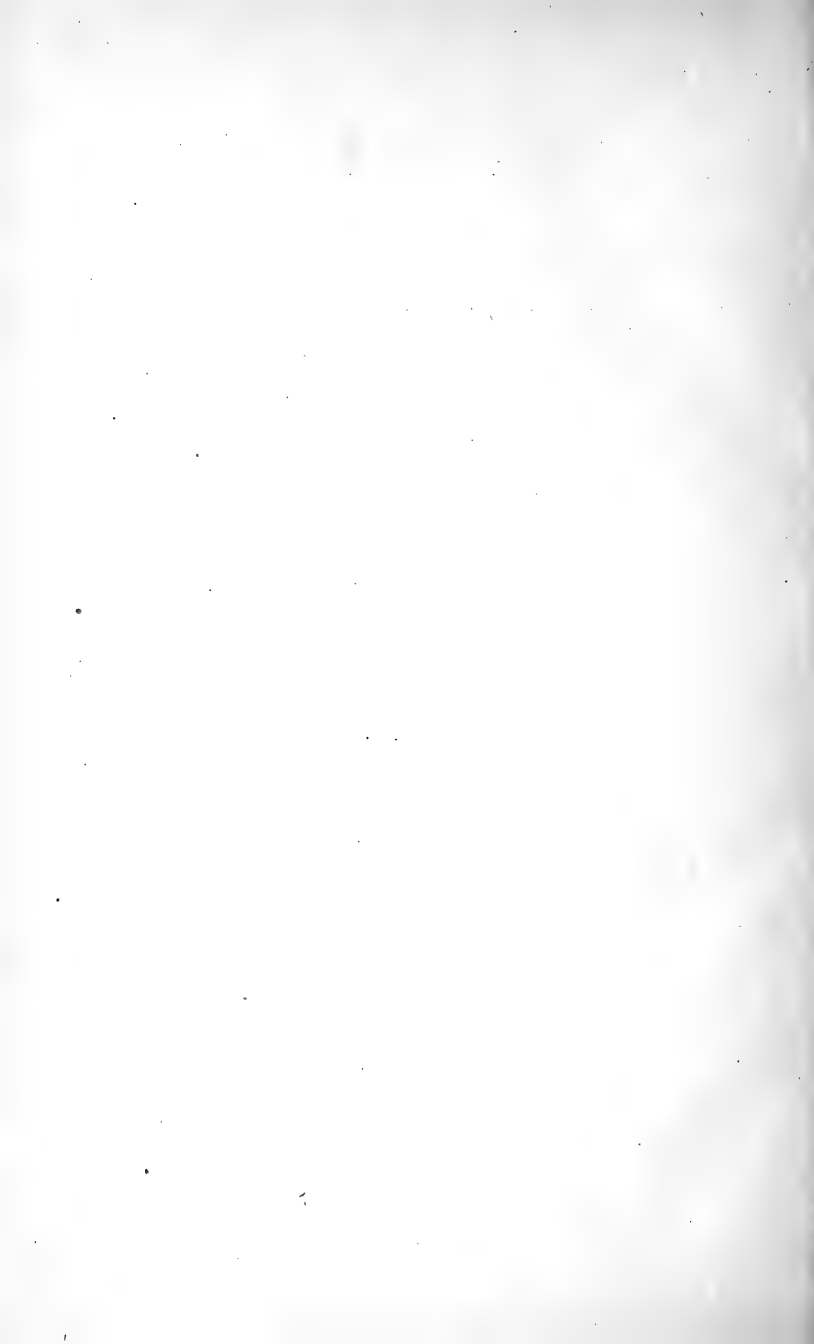
## DISTRIBUTION BY STATION MESSENGERS—Continued.

Name of station.	Species.	Number of fish.	Size.	Total cost.	Average cost per thousand.	Miles paid.	Miles free.
Craig Brook, Me.	Trout.....	107,750	Fingerlings, 1-5 inch.	\$217.73	\$2.02	4,091	.....
Do.	Salmon.....	11,600	Fingerlings, 2-3 inch.	117.45	10.124	2,284	.....
Do.	Humpback salmon.	320,000	Fry.....	13.50	.0422	80	.....
Duluth, Minn.	Whitefish.....	9,610,000	do.....	139.20	.014	263	.....
Do.	Pike perch.....	23,100,000	Fry and eggs.....	143.12	.0064	5,062	.....
Do.	Trout.....	10,295,000	Fingerlings, 1-2 inch.	593.60	.0576	.....	.....
Do.	do.....	516,580	Fingerlings, 1-2 inch.	318.43	.616	4,858	.....
Erwin, Tenn.	do.....	497,360	Fingerlings, 1-4 inch.	832.11	1.67	15,413	352
Do.	Pond fishes.....	24,820	Fingerlings, 2-4 inch.	272.06	10.97	7,051	40
Edenton, N. C.	Shad.....	1,620,000	Fry.....	103.60	.064	2,656	36
Do.	Pond fishes.....	16,900	do.....	120.70	7.142	2,785	.....
Do.	do.....	25,200	Fingerlings, 1-3 inch.	249.38	9.896	5,507	31
Green Lake, Me.	Trout.....	175,000	Fry.....	6.10	.0348	59	.....
Do.	Smelt.....	3,000,000	do.....	92.54	.30801	2,284	.....
Do.	Salmon.....	44,000	do.....	21.30	.484	304	.....
Homer, Minn.	Pike perch.....	3,350,000	do.....	71.18	.212	1,114	.....
Do.	Yellow perch.....	200,000	do.....	4.79	.023	114	.....
Do.	Pond fishes.....	35,245	Fingerlings, 2-6 inch.	560.88	15.91	12,362	.....
La Crosse, Wis.	do.....	92,250	Fingerlings, 1-6 inch.	609.93	6.61	11,766	.....
Do.	Trout.....	113,000	Fingerlings, 2 inch.....	33.58	.297	518	.....
Do.	Pike perch.....	3,780,000	Fry.....	127.15	.03363	3,495	.....
Leadville, Colo.	Trout.....	848,500	Fingerlings, 1-3 inch.	94.30	.111	8,804	.....
Louisville, Ky.	Pond fishes.....	26,300	do.....	223.49	8.49	6,090	.....
Manchester, Iowa.	Pike perch.....	2,900,000	Fry.....	88.49	.0305	2,802	.....
Mammoth Spring, Iowa.	Pond fishes.....	389,500	do.....	656.22	1.68	13,951	.....
Do.	do.....	45,155	Fingerlings, 1-2 inch.	593.33	13.13	12,235	.....
Do.	do.....	180	Adults.....	72.55	403.05	1,770	.....
Nashua, N. H.	Trout.....	283,800	Fry.....	119.86	.42	2,775	.....
Do.	Pond fishes.....	2,400	do.....	1.68	.70	28	.....
Do.	Trout.....	10,000	Fingerlings, 1 inch.....	42.38	4.238	647	.....
Do.	do.....	27	Adults.....	6.67	247.00	136	.....
Neosho, Mo.	Pond fishes.....	3,310	Fry.....	27.62	8.34	646	.....
Do.	do.....	73,378	Fingerlings, 1-7 inch.	530.88	7.23	15,095	.....
Do.	do.....	330	Yearlings.....	22.76	68.97	590	.....
Do.	Trout.....	156,387	Fingerlings, 1-3 inch.	225.60	1.44	5,410	.....
Northville, Mich.	Whitefish.....	4,500,000	Fry.....	36.85	.00818	.....	458
Do.	Trout.....	4,205,000	Fry and eggs.....	96.28	.02289	1,396	1,806
Do.	Pike perch.....	12,600,000	Fry.....	71.65	.00568	25	366
Do.	Pond fishes.....	225,000	do.....	214.63	.953	3,643	3,594
Do.	Grayling.....	25,000	do.....	6.00	.24	.....	2,270
Do.	Pond fishes.....	10,575	Fingerlings, 1-2 inch.	79.75	7.54	371	1,995
Do.	Trout.....	79,500	Fingerlings, 1½ inch.....	89.87	1.13	532	2,707
Orangeburg, S. C.	Pond fishes.....	107,500	Fingerlings, 1 inch.....	194.75	1.81	3,773	.....
Quincy, Ill.	Pike perch.....	1,600,000	Fry.....	34.10	.021	825	.....
St. Johnsbury, Vt.	do.....	52,400,000	do.....	338.95	.00646	5,936	.....
Do.	Pond fishes.....	8,000	do.....	4.88	.61	264	.....
Do.	do.....	5,475	Fingerlings, 1-3 inch.	133.55	24.392	1,206	.....
Do.	Trout.....	1,474,300	Fry.....	314.52	.213	5,435	.....
Do.	do.....	346,511	Fingerlings, 1-2½ inch.	336.89	.972	7,390	58
San Marcos, Tex.	Pond fishes.....	347,002	Fingerlings, 1-4 inch.	843.75	2.43	49	24,125
Saratoga, Wyo.	Trout.....	185,000	Fry.....	109.10	.59	1,334	184
Do.	do.....	471,000	Fingerlings, 1-1½ inch.	294.16	.624	4,463	1,324
Spearfish, S. Dak.	do.....	525,000	do.....	190.87	.363	3,252	.....
Tupelo, Miss.	Pond fishes.....	166,000	Fry.....	125.99	.759	1,918	.....
Do.	do.....	143,000	Fingerlings, 1-6 inch.	693.88	4.852	13,335	44
White Sulphur, W. Va.	do.....	70,000	Fry.....	90.29	1.298	1,649	.....
Do.	Trout.....	149,700	Fingerlings, 1-2 inch.	250.65	1.674	5,718	.....
Wytheville, Va.	Pond fishes.....	29,000	Fry.....	31.11	1.07	663	.....
Do.	do.....	42,641	Fingerlings, 1-6 inch.	309.82	7.265	7,395	.....
Do.	Salmon.....	4,800	Fry.....	25.90	5.395	620	.....
Do.	Trout.....	87,710	Fingerlings, 1-3 inch.	170.92	1.95	3,531	.....
Woods Hole, Mass.	Flatfish.....	75,685,000	Fry.....	74.90	.000989	859	72

METHOD OF DISTRIBUTION, BY STATIONS, SPECIES, NUMBER, AND SIZE OF FISH,  
AND COSTS—Continued.DISTRIBUTION BY CARS.<sup>a</sup>

Name of station.	Species.	Number of fish.	Size.	Total cost.	Average cost per thousand.	Miles paid.	Miles free.
Battery, Md.....	Yellow perch.	11,000,000	Fry.....	\$144.20	\$0.0129	622	-----
Beaufort, N. C....	Salt water....	275	Adults.....	256.12	931.34	1,207	82
Bozeman, Mont..	Trout.....	1,571,350	Fry and fingerlings (2-inch).	1,050.08	.668	4,636	4,483
Craig Brook, Me..	Salmon.....	624,000	Fry and fingerlings (1-inch).	228.00	.365	600	-----
Erwin, Tenn.....	Trout.....	910,000	Fingerlings, 1-3 inch.	2,272.80	2.497	8,564	-----
Green Lake, Me..	.....do.....	831,016	Fingerlings, 1-inch...	454.70	.547	1,922	-----
Do.....	Salmon.....	3,036,224	Fry.....	373.05	.123	2,066	-----
Leadville, Colo...	Trout.....	2,028,146	Fingerlings, 1-3 inch.	1,063.96	.524	1,802	9,715
Manchester, Iowa.	.....do.....	1,025,567	Fingerlings, 1-4 inch.	1,628.67	1.58	8,140	-----
Northville, Mich..	Pond fishes...	88,933	Fingerlings, 1-3 inch.	1,192.77	13.40	6,159	-----
Put in Bay, Ohio.	Pike perch....	9,600,000	Fry.....	153.51	.016	631	-----
Quincy, Ill.....	Pond fishes...	29,360	Fingerlings, 1-5 inch.	1,759.37	59.92	7,664	152
Spearfish, S. Dak.	Trout.....	92,000	Fingerlings, 1-2½ inch.	153.40	1.69	1,008	-----
Upper Mississippi collecting station. <sup>b</sup>	Pond fishes...	228,062	Fingerlings, 1-5 inch.	5,132.04	22.50	23,912	-----
Do.....	.....do.....	7,846	Adults.....	1,055.25	134.49	7,743	-----
White Sulphur, W. Va.	Trout.....	876,751	Fingerlings, 1-4 inch.	2,011.50	2.294	6,267	-----
Wytheville, Va...	.....do.....	531,562	Fingerlings, 1-3 inch.	1,741.60	3.276	3,715	-----

<sup>a</sup> Distribution by cars shows cost of transporting fish to destination or until delivered to car messenger.<sup>b</sup> La Crosse, Bellevue, and North McGregor.



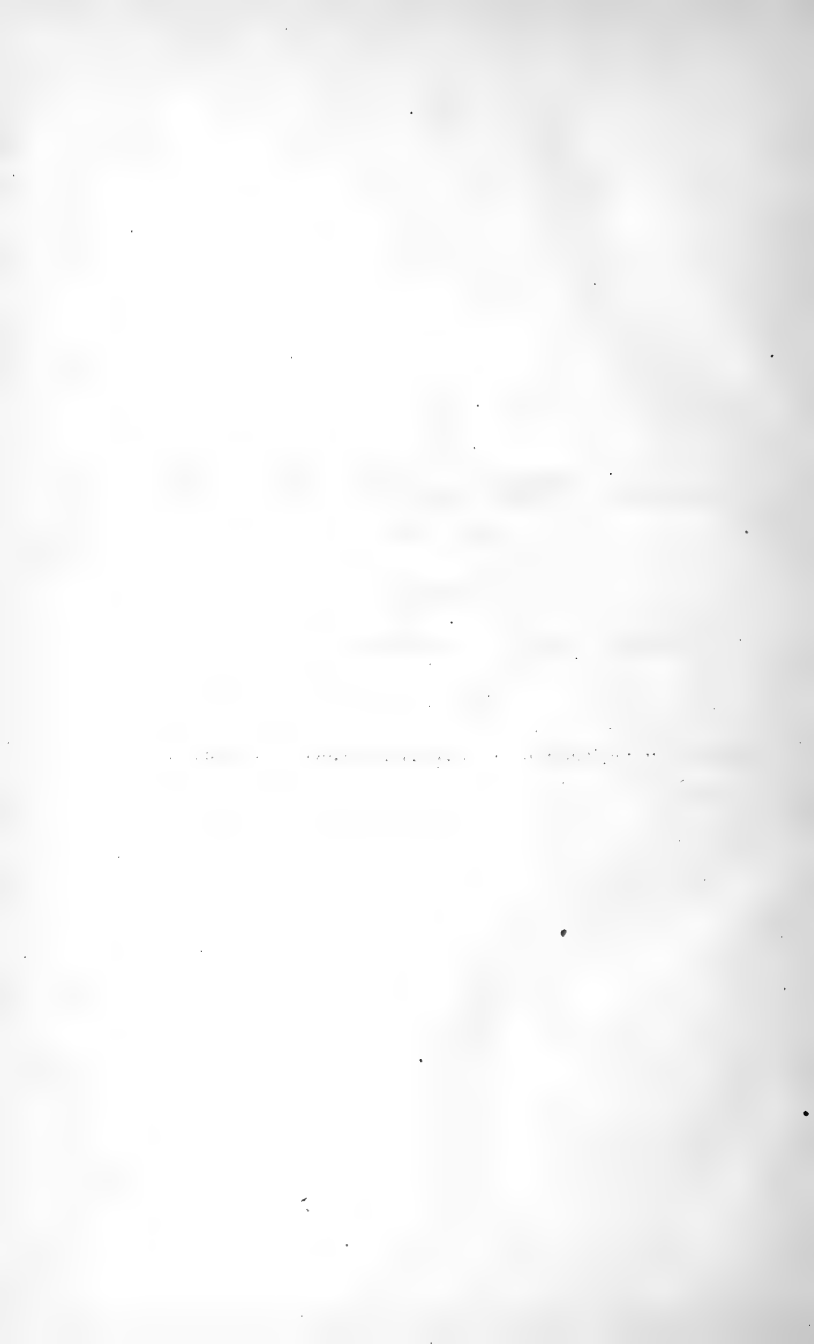
# ALASKA FISHERIES AND FUR INDUSTRIES IN 1917

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By **WARD T. BOWER**, *Agent*, and **HENRY D. ALLER**, *Assistant*

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Appendix II to the Report of the U. S. Commissioner of Fisheries for 1917



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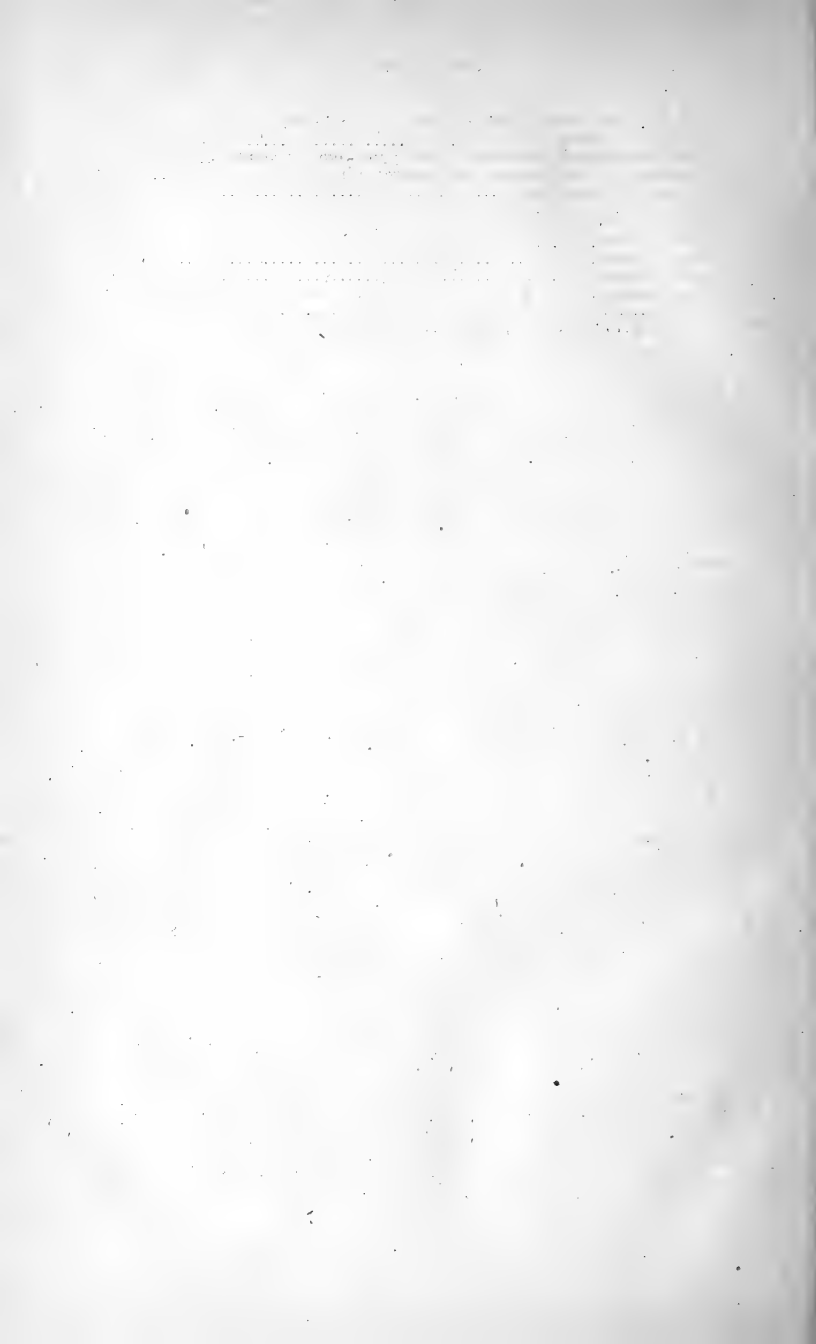
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# ALASKA FISHERIES AND FUR INDUSTRIES IN 1917.

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By **WARD T. BOWER**, *Agent Alaska Service*, and **HENRY D. ALLER**, *Assistant, Alaska Service*.

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## INTRODUCTION.

Broadly considered, the work of the Bureau of Fisheries in Alaska has been devoted to the enforcement of the laws and regulations for the protection of the fisheries and fur-bearing animals; the administration of the Pribilof Islands Reservation, and matters incidental thereto; the collection of statistics and the dissemination of information regarding the fisheries; the making of certain scientific investigations, chiefly in regard to the life history of the salmon and in connection with the fur-seal herd; and the conduct of fish-cultural operations.

In respect to the fisheries proper it may be said that much time has been given to the enforcement of the laws and regulations. Various prosecutions have been instituted when necessary from time to time. In the season of 1917 the Bureau was enabled to extend its patrol in southeastern Alaska by reason of having acquired two additional boats, the *Auklet* and the *Murre*. These boats were completed early in the year, having been designed especially for the Alaska fisheries service. Regular inspection of fishery operations was continued along the usual lines, and a census of the salmon ascending Wood River (Lake Aleknagik) was again made. Private hatcheries were inspected. Considerable work was also done in removing natural barriers in streams, thus opening them up to spawning salmon.

Hearings were held in regard to limiting or prohibiting salmon fishing in the waters of the Karluk, Bering, and Copper Rivers. As a result, formal orders were issued by the Department restricting fishery operations in these waters. Detailed statistics embracing practically all features of importance pertaining to the varied fishery industries of the Territory were assembled.

Important work undertaken in 1917 was the introduction in Alaska of the Scotch method of curing herring. For this work the Bureau sent to the Territory a fishery expert and a number of special assistants who gave practical demonstrations of the method to various interested persons.

In connection with the Pribilof Islands, attention was given to the support of the natives, the taking and preserving of fur-seal and fox skins and the repair and construction of dwellings occupied by the natives and of other buildings used for the general work of the Bureau. Collections of bones were made from the deposits on the killing fields of the Pribilof Islands. The steamer *Roosevelt* was used for the transportation of freight and passengers to and from

the Pribilofs in 1917. Two round trips, the second extending into January, 1918, were made from Seattle.

The period provided by law, in which the killing of fur seals at the Pribilof Islands was virtually limited to the food requirements of the native inhabitants, expired August 24, 1917, after which date the Department was free to resume the taking of skins for commercial purposes. The securing of skins to any considerable extent in the fall of the year, however, is necessarily restricted by reason of the so-called stagy season extending for a period of several weeks after August 24, unfavorable weather conditions, and the departure of the seals on the annual migration southward. An important feature of the work on the Pribilof Islands was the taking of a census of the fur-seal herd. During the year three sales of fur-seal skins and one of fox skins, products of the Pribilofs, were held at St. Louis, Mo.

The enforcement of the general law for the protection of the miscellaneous fur-bearing animals in Alaska remains as one of the duties of the Bureau. Field work was carried on by wardens and other employees of the Alaska service as far as practicable. Statistics of shipment of furs from Alaska were collected. A reconsideration of the method of cooperation on the part of the Post Office Department in respect to shipments of furs resulted in a more satisfactory arrangement being put in operation.

The authors of this report are indebted to Assistant Agent E. M. Ball for valuable aid in tabulating the statistics of the fisheries and in the preparation of much of the accompanying text.

#### EMPLOYEES, ALASKA SERVICE.

During the year 1917 the following regular employees have been identified with the Alaska service of the Bureau:

##### REGULAR EMPLOYEES IDENTIFIED WITH THE ALASKA SERVICE IN 1917.

Name.	Position.	Headquarters or chief place of duty.
Ward T. Bower.....	Chief agent.....	Washington, D. C.
Henry D. Aller.....	Assistant.....	Do.
Edward M. Ball.....	Assistant agent.....	Kodiak, Alaska.
Harry J. Christoffers.....	do.....	Seattle.
Ernest P. Walker.....	Inspector.....	Wrangell.
James H. Iyman.....	Assistant agent.....	Cordova.
Harry C. Fassett.....	Agent and caretaker.....	St. Paul Island.
A. H. Proctor.....	do.....	St. George Island.
G. Dallas Hanna.....	Storekeeper.....	St. Paul Island.
William T. Miles.....	Physician.....	St. Paul and St. George Islands.
Henry P. Adams.....	do.....	St. George Island. (Resigned Nov. 21, 1917.)
William B. Hunter.....	do.....	St. Paul Island. (Appointed Nov. 22, 1917.)
George Haley.....	School-teacher.....	St. Paul Island.
Cora Giles Haley.....	do.....	Do.
Arnold C. Reynolds.....	do.....	St. George Island.
Calvin F. Townsend.....	Warden.....	Fairbanks.
Fred H. Gray.....	do.....	Wrangell.
Shirley A. Baker.....	do.....	Dillingham.
Harry H. Brown.....	do.....	Nushagak. (Resigned Apr. 20, 1917.)
Christian L. Larson.....	do.....	Chicken.
Henry C. Seudder.....	do.....	St. Paul Island and Wrangell.
Jesse L. Nevill.....	do.....	Wrangell. (Appointed June 17, 1917.)
Charles E. Crompton.....	do.....	St. Paul Island. (Appointed May 3, 1917.)
Edwin Hoistad.....	Master steamer Osprey.....	Wrangell.
Albert K. Brown.....	Clerk.....	Washington, D. C.
Mary S. Haines.....	do.....	Do.
William P. Rasin.....	do.....	Do.
E. Elaine Bell.....	do.....	Seattle.

## REGULAR EMPLOYEES AT GOVERNMENT HATCHERIES IN ALASKA IN 1917.

Name and location.	Position.
<b>Afognak:</b>	
Edwin Wentworth.....	Superintendent.
G. C. Robertson.....	Foreman.
John Naumoff.....	Fish-culturist. (Resigned Nov. 15, 1917.)
W. E. Sullivan.....	Fish-culturist.
Alfred Nelson.....	Apprentice fish-culturist.
Nicolai Boskofsky.....	Apprentice fish-culturist. (Resigned Nov. 30, 1917.)
Russell Noyes.....	Apprentice fish-culturist.
F. J. Stewart.....	Cook.
<b>Yes Bay:</b>	
Charles B. Grater.....	Superintendent.
C. H. Van Atta.....	Foreman.
Kenneth P. Hutton.....	Fish culturist.
J. H. Tierney.....	Do.
Clarence B. Rivers.....	Apprentice fish-culturist.
C. N. Blystad.....	Do.
T. H. Morton.....	Apprentice fish-culturist. (Resigned Dec. 31, 1917.)
M. T. Tierney.....	Cook.

## FISHERY INDUSTRIES.

As in similar reports for previous years, the Territory of Alaska is here considered in the four coastal geographic sections generally recognized as follows: Southeast Alaska, embracing all that narrow strip of mainland and the numerous adjacent islands from Portland Canal northwestward to and including Yakutat Bay; central Alaska, the region on the Pacific from Yakutat Bay westward, including Prince William Sound, Cook Inlet, and Chignik; western Alaska, the shores of Bering Sea, tributary waters, and the islands in Bering Sea; and arctic Alaska, all that portion of Alaska facing on or tributary to the Arctic Ocean.

Detailed reports and statistical tables dealing with the various fishery industries are presented herewith, and there are also given the important features of certain subjects which were the object of special investigation or inquiry.

### WATERS CLOSED TO COMMERCIAL FISHING.

Section 6 of the act approved June 26, 1906, for the protection and regulation of the fisheries of Alaska, is as follows:

That the Secretary of Commerce may, in his discretion, set aside any streams or lakes as preserves for spawning grounds, in which fishing may be limited or entirely prohibited; and when, in his judgment, the results of fishing operations in any stream, or off the mouth thereof, indicate that the number of salmon taken is larger than the natural production of salmon in such stream, he is authorized to establish close seasons or to limit or prohibit fishing entirely for one year or more within such stream or within five hundred yards of the mouth thereof, so as to permit salmon to increase: *Provided, however,* That such power shall be exercised only after all persons interested shall be given a hearing, of which due notice must be given by publication; and where the interested parties are known to the Department they shall be personally notified by a notice mailed not less than thirty days previous to such hearing. No order made under this section shall be effective before the next calendar year after same is made: *And provided further,* That such limitations and prohibitions shall not apply to those engaged in catching salmon who keep such streams fully stocked with salmon by artificial propagation.

Pursuant to the provisions of this section action was taken in 1917 in respect to the waters of Karluk, Bering, and Copper Rivers.

Under date of July 31, 1917, announcement was made of a hearing to be held in respect to the Karluk River. The text of the announcement was as follows:

Whereas it has been recommended that the Secretary of Commerce limit or prohibit all fishing in Karluk River and Lagoon, and tributary waters, Alaska, notice is hereby given under the provisions of section 6 of the act of Congress approved June 26, 1906, entitled "An act for the protection and regulation of the fisheries of Alaska," that a hearing to determine the advisability of limiting or prohibiting fishing operations in the above-named waters will be held in room 328, customhouse, San Francisco, Cal., on November 15, 1917, at 10 o'clock a. m., at which time and place all persons interested will be heard.

Following the hearing on November 15, 1917, the Department under date of November 30, 1917, promulgated the following order:

A hearing having been given at San Francisco, Cal., November 15, 1917, after due notice in accordance with law, for the purpose of determining the advisability of

establishing a salmon-breeding reserve of certain waters in Alaska, and all persons having had full opportunity to be heard, it is hereby ordered, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, that until further notice all fishing for salmon, or other fishing in the prosecution of which salmon are taken or injured, excepting only the native Indians taking limited numbers of salmon for their own consumption and not for sale or barter, be and is hereby prohibited in waters of Alaska, as follows: In Karluk River and Lagoon and all tributary waters.

This order becomes effective January 1, 1918.

Under date of September 24, 1917, announcement was made of a hearing to be held in respect to Bering River. The text of the announcement was as follows:

Whereas it has been recommended that the Secretary of Commerce limit or prohibit commercial fishing for salmon, or other commercial fishing in the prosecution of which salmon are taken or injured, in Bering River and all tributary waters, including Bering Lake, above a line extending at right angles across Bering River from a point approximately 800 feet northwesterly from the mouth of Gandil River, Alaska, notice is hereby given under the provisions of section 6 of the act of Congress approved June 26, 1906, entitled "An act for the protection and regulation of the fisheries of Alaska," that a hearing to determine the advisability of limiting or prohibiting fishing operations in the above-named waters will be held at the office of the Bureau of Fisheries, 1217 L. C. Smith Building, Seattle, Wash., on November 20, 1917, at 10 o'clock a. m., at which time and place all persons interested will be heard.

Following the hearing on November 20, 1917, the Department under date of November 30, 1917, promulgated the following order.

A hearing having been given at Seattle, Wash., November 20, 1917, after due notice in accordance with law, for the purpose of determining the advisability of establishing a salmon-breeding reserve of certain waters in Alaska, and all persons having had full opportunity to be heard, it is hereby ordered, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, that until further notice all fishing for salmon, or other fishing in the prosecution of which salmon are taken or injured, be and is hereby prohibited in waters of Alaska, as follows: Bering River and all tributary waters, including Bering Lake, above a line extending at right angles across Bering River from a point approximately 800 feet northwesterly from the mouth of Gandil River, Alaska.

This order becomes effective January 1, 1918.

Under date of November 1, 1917, announcement was made of a hearing to be held in respect to the Copper River. The announcement was as follows:

Whereas it has been recommended that the Secretary of Commerce limit commercial fishing for salmon, or other commercial fishing in the prosecution of which salmon are taken or injured, in Copper River and its delta, and in all tributary waters, in Alaska, notice is hereby given under the provisions of section 6 of the act of Congress approved June 26, 1906, entitled "An act for the protection and regulation of the fisheries of Alaska," that a hearing to determine the advisability of limiting fishing operations in the above-named waters will be held at the office of the Bureau of Fisheries, 1217 L. C. Smith Building, Seattle, Wash., on December 14, 1917, at 10 o'clock a. m., at which time and place all persons interested will be heard.

Following the hearing on December 14, 1917, the Department under date of December 29, 1917, promulgated the following order:

A hearing having been given at Seattle, Wash., December 14, 1917, after due notice in accordance with law, for the purpose of determining the advisability of establishing a salmon-breeding reserve of certain waters in Alaska, and all persons having had full opportunity to be heard, it is hereby ordered, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, that until further notice all fishing for salmon or other fishing in the prosecution of which salmon are taken or injured, in the Copper River and its delta and all tributary waters, Alaska, be and is hereby made subject to the following limitations and prohibitions in addition to the general restrictions already applicable by virtue of existing laws and regulations:

1. Commercial fishing is prohibited in all waters of the Copper River delta from 6 a. m. on January 1 to 6 a. m. on June 1 of each year, and in the waters of Miles Lake and Abercrombie Canyon from 6 a. m. on January 1 to 6 a. m. on June 5 of each year.

2. A weekly close season from 6 p. m. Saturday to 6 a. m. of the Monday following shall be observed in all of the waters herein referred to in which fishing is permitted.

3. Commercial fishing in the waters of the delta shall be limited to set nets, stake nets, and drift gill nets: *Provided, however*, That the four existing traps east of Cape Whitted may be continued in operation, but without change of location or increase in size. No stake net, set net, or drift gill net shall exceed 1,000 feet in length. Only one stake net or set net shall be extended out from shore from one location, and no offshore stake nets or set nets will be permitted; the lateral distance interval between all such nets in the waters of the delta shall be not less than 1,800 feet.

4. All fishing is prohibited from the head of the delta to the foot of Miles Lake at all times.

5. All fishing in Miles Lake shall be limited to stake nets and set nets. No such net shall exceed 600 feet in length, and only one such net shall be extended out from shore from one location; no offshore nets will be permitted in the lake. The lateral distance interval between all nets in Miles Lake shall be not less than 600 feet.

6. Fishing in Abercrombie Canyon shall be restricted to the use of dip nets operated by hand, such nets not to exceed 16 inches in greatest diameter and only one dip net shall be operated by a person. On the east side of the canyon there shall be distance intervals of at least 300 feet between fishermen operating dip nets. No fishing will be permitted in the so-called Bear Holes, near the upper end of Abercrombie Canyon.

7. No fishing will be permitted at any time in the waters of the Copper River above Abercrombie Canyon, or in any of the waters tributary thereto, except in the case of local residents who may take limited numbers of salmon for domestic use: *Provided*, That such fishing shall at no time be upon the spawning grounds of any salmon.

8. No set net or stake net shall be operated in any other than substantially a straight line.

9. For the purposes herein considered, the delta of the Copper River will be regarded as including all waters south of an east-and-west line passing through Mile 27 on the Copper River & Northwestern Railway, as at present established, and inside of a line from Point Martin to Cape Whitted drawn so as to include the waters of the Martin Islands, the Egg Islands, and all tidal flats and islands between.

10. The lower end of Miles Lake shall be considered as at the bridge of the Copper River & Northwestern Railway at Mile 49. The upper end of Miles Lake shall be considered as at a point near Mile 52½ on the Copper River & Northwestern Railway where the river loses its identity in the lake, this point to be as indicated by notices posted by duly authorized representatives of the Bureau of Fisheries.

11. Abercrombie Canyon shall be considered as extending from the upper end of Miles Lake to Tunnel Point, near Mile 53½ on the Copper River & Northwestern Railway.

12. For the purposes of this order the following definitions are adopted to apply to the words in question where the same are used: "Stake net," a gill net attached or affixed to piles or stakes. "Set net," an anchored gill net.

This order becomes effective January 1, 1918.

Previous orders by the Secretary of Commerce place special limitations and inhibitions upon operations in the following waters: In western Alaska—Wood and Nushagak Rivers; in central Alaska—all streams flowing into Cook Inlet, Eyak Lake, and a limitation on fishing in Eyak River; in southeast Alaska—Anan Creek, Naha Stream, all waters tributary to Barnes Lake, Prince of Wales Island, Hetta Creek and its tributary waters and the region within 500 yards of the mouth of said creek; and Sockeye Creek, its tributary Boca de Quadra waters, and the region within 500 yards of the mouth of said creek. By authority of Executive order and proclamation, limitations have been placed upon fishing in the following additional waters: Afognak Reservation, Aleutian Islands Reservation, Yes Bay and Stream, and the Annette Island Fishery Reserve.



**STREAM IMPROVEMENT.**

Consideration has been given during the year to plans for improving and opening up a number of salmon streams in southeastern Alaska inaccessible to salmon because of falls or other natural barriers. This matter has been under the general supervision of Inspector Walker, of the Alaska service. He has reported that the obstructions may be grouped into four general classes: (1) Falls caused by rock ledges or strata that have not been worn away; (2) log jams resulting either from natural causes or from artificial obstructions; (3) rock jams consisting of loose rocks or boulders in such position as to be barriers in themselves or to cause the currents to be so broken that fish can not pass through them; and (4) dams constructed for power purposes, and occasionally dams built by beavers.

Some of the log jams change from time to time, increasing generally in size and impenetrability. They are of two general classes—(a) those where the water flows over the top of the jam and (b) where it trickles through spaces between the logs.

Such barriers as log jams or falls ordinarily absolutely prevent the passage of fish, but in some cases at certain stages of the water a few salmon may be able to pass. Some of the obstructions are not particularly formidable, while others are extensive and will necessitate a great deal of work to open the way for the passage of salmon. Not infrequently small barriers prevent absolutely the ascent of salmon to excellent spawning grounds of considerable extent. The practical results of thus increasing the natural spawning areas are obvious.

In June and July, 1916, improvements were made on Skog Creek on Kupreanof Island, opposite Scow Bay, and at a salmon stream at Pavlof Harbor, near the entrance of Freshwater Bay, on Chichagof Island. Both of these streams were so improved that salmon may now readily ascend the falls. The success of this work clearly shows the need of extensions to other streams as fast as time and funds permit.

**ALASKA FISHERY INTELLIGENCE SERVICE.**

A senate joint memorial passed by the legislature of Alaska in April, 1917, requested that the Bureau of Fisheries in conjunction with the Washington-Alaska Military Cable and Telegraph System arrange that the prices of fresh fish at Seattle and Ketchikan be bulletined every day at the cable office of every town on the Alaska coast where fishing vessels call for the purpose of shipping fish southward and that once a week the prices of salt fish of the varieties caught in Alaska waters be bulletined at the cable offices of the coast.

The War Department, which operates the Washington-Alaska Military Cable and Telegraph System, expressed its willingness to receive, transmit, and post bulletins furnished by the Bureau of Fisheries, and early in July the service was initiated. At first the work was limited to information regarding Seattle prices, but was soon extended to include prices at Ketchikan. The intelligence service as finally fixed upon included: (1) Forwarding each day, Sundays and holidays excluded, to Juneau, Petersburg, Ketchikan, Wrangell, Sitka, Valdez, Seward, Cordova, and Skagway the Seattle

prices at noon for fresh halibut, sablefish, and red rockfish; (2) inclusion with the Seattle quotations on Monday of each week the prices of pickled sablefish, salmon, and herring; and (3) furnishing from Ketchikan local information, corresponding to that furnished from Seattle, to the other Alaska towns supplied with the Seattle quotations.

The purpose of this service is to keep the fishermen in touch with market conditions that they may dispose of their catches more profitably and thereby be induced to increase the production of fish. The service has met with general favor.

#### PATROL BOATS.

With the development of the fishery resources of Alaska from year to year, new localities are fished and new canneries and other fishery establishments are built. With each extension of activities, the territory that must be patrolled by the field agents of the Bureau is increased, but the facilities for covering the various districts remain extremely inadequate. Until 1917, the *Osprey* (23 tons) was the only Government boat engaged in a patrol of the fisheries of Alaska, being assigned to the southeastern district. In October, 1916, this vessel was brought to Seattle for repairs and did not return to Alaskan waters until January, 1918.

In December, 1916, a contract was made for the construction of two patrol boats, each to be 48 feet in length, 12½ feet in breadth, and equipped with a 25-30 horsepower heavy-duty Standard engine. These boats, the *Murre* and *Auklet*, were completed and put in commission in July, 1917, and immediately proceeded to Alaska, where they were engaged in patrol work during the remainder of the season. They are of plain and substantial construction similar to the seaworthy type of purse-seine boat familiar to the Pacific coast.

The schooner *Nimrod* (8 tons) was chartered for work along the central coast of Alaska from Cook Inlet to False Pass during the summer months. The launches *Angelus* and *Buzzard* were chartered at different times for use in patrol work on Prince William Sound. A small launch was hired also for brief service in the Nushagak region.

The representatives of the Alaska service in central and western Alaska are not able to cover the districts to which they are assigned without some assistance from the canning companies. As usual, several of the companies furnished free transportation to the agents in those districts. Were it not for these gratuities, much of the territory could not be visited, as suitable boats can not be chartered. Gratuitous service of this character is wrong in principle, but until Congress provides additional funds for more vessels, there appears to be no alternative in the case of those employees of the Bureau who are called to certain remote and inaccessible regions.

#### VIOLATIONS OF LAWS AND REGULATIONS.

Prosecutions for violations of the fishery laws and regulations were made for disregard of the weekly close season, for the operation of gear within the prohibited distance of other gear, and for failure to provide pound nets with distinctive signs whereby ownership could be determined.

A complaint was made before the United States commissioner at Ketchikan on August 18, 1917, against J. S. Hume, superintendent of the Nakat Inlet cannery of the G. W. Hume Co., charging the operation of a trap on the north shore of Kanagunut Island on August 6 and 7 without a sign bearing the name, number, or other distinctive mark, contrary to the general regulations promulgated under the authority of section 11 of the act of June 26, 1906. The case was called for trial on August 24, at which time a plea of guilty was entered, whereupon a fine of \$25 and costs was imposed.

On August 24, a complaint was made before the United States commissioner at Wrangell against Frank Adams, who was charged with unlawful fishing on Sunday, August 12, and with the setting of nets in the Stikine River for a distance greater than one-third the width of the channel. A plea of guilty being entered, the defendant was discharged upon payment of the costs of the case.

In October, 1917, the grand jury at Juneau indicted the Alaska Pacific Fisheries for four violations of the fishery law during the season of 1917. Two of these indictments alleged that the company operated two traps on Lynn Canal, one each at Sand Spit and Seduction Point, without proper signs to indicate their ownership; another charged a nonobservance of the weekly close period in respect to a trap operated at Idaho Inlet on August 11. The remaining indictment was based upon the allegation that the company on or about August 15 installed a floating trap within less than 600 yards laterally of a trap then in operation by the Thlinket Packing Co., near Village Point on the north shore of Icy Strait. When these cases were called for trial at Juneau on December 15, pleas of guilty were entered in respect to the operation of traps on Lynn Canal and Idaho Inlet as alleged, and fines of \$300 and costs and \$500 and costs were paid, respectively. The case involving an encroachment on the distance interval between traps was called but was continued until a term of the court to be held in the spring of 1918.

The Northwestern Fisheries Co. was also indicted by the grand jury at Juneau in October for a violation of the weekly close season on Sunday, August 26, 1917. A pound net in Tolstoi Bay on the east coast of Prince of Wales Island was found to be improperly closed. The case was called for trial at Ketchikan on November 15, when the company pleaded guilty. A fine of \$500 was paid.

On Sunday, August 12, 1917, the heart walls of nine traps operated by the Deep Sea Salmon Co. in Port Althorp were found not to be adjusted in accordance with law. This matter was taken before the United States commissioner at Juneau on October 5, formal charge being made against Jens Kvalvik, trap foreman, who entered a plea of guilty, whereupon a fine of \$250 was imposed.

The Alaska Packers Association was convicted of the wanton waste of salmon on Cook Inlet in 1914 at a term of the district court held at Valdez in September, 1916. The case was carried to the circuit court of appeals at San Francisco which, in an opinion delivered in the summer of 1917, upheld the lower court.

The case against the Canoe Pass Packing Co. charging the wanton waste of salmon on July 22 and 23, 1916, at Windy Bay, Prince William Sound, came to trial at Cordova in April, 1917, and resulted in an acquittal of the company.

On April 9, 1917, the Carlisle Packing Co. was arraigned in the district court at Cordova for three violations of the fishery laws in July, 1916. The company pleaded guilty and a fine was imposed for each offense.

A complaint was filed in the United States commissioner's court at Cordova on September 15, charging Frank Lee with unlawful fishing in Eyak River. The defendant pleaded guilty and paid a fine of \$5.

On September 11, 1917, Joe Enos was brought before the United States commissioner at Fairbanks and charged with unlawful fishing in Clear Creek. He entered a plea of guilty and paid a fine of \$25 and the costs of the prosecution, which amounted to an additional \$10.15.

#### TERRITORIAL LEGISLATIVE NOTES.

The Legislature of the Territory of Alaska, at its third regular biennial session at Juneau in 1917, amended sections 1 and 2 of the Territorial revenue act of April 29, 1915, chapter 76, Laws of Alaska, 1915. The changes, in so far as they affect the fishery industry, provide for increased tax rate on all canned salmon, kings, reds, or sockeyes being taxed  $4\frac{1}{2}$  cents per case, medium reds  $2\frac{1}{2}$  cents per case, and all others 2 cents per case. This is an increase of one-half cent per case on kings, reds, and medium reds, and 1 cent per case on pinks and chums. The tax on salted or mild-cured fish remains unchanged at  $2\frac{1}{2}$  cents per 100 pounds, as does also the tax of \$100 per annum on all fish traps. The tax of \$1 per 100 fathoms on gill nets was repealed. Cold-storage plants are taxed according to the amount of annual business, which was determined formerly on the basis of the purchase price of product, but now upon the gross amount received for the product and for storage of produce for others. Fish oil is taxed at the rate of \$2 per barrel when manufactured wholly or in part from herring; fertilizer and fish meal made wholly or in part from herring are taxed at the rate of \$2 per ton. The act, approved May 3, 1917, as it applies to fisheries is as follows:

SECTION 1. That Sections 1 and 2 of Chapter 76, Laws of Alaska, 1915, approved April 29, 1915, be and the same are hereby amended to read as follows:

"SECTION 1. That any person, firm or corporation prosecuting or attempting to prosecute any of the following lines of business in the Territory of Alaska shall apply for and obtain a license and pay for said license for the respective lines of business as follows:

\* \* \* \* \*

"Sixth. Fisheries: Salmon canneries, four and a half cents per case on King and Reds or Sockeye; Two and a half cents per case on Medium Reds; two cents per case on all others.

"Seventh. Salteries: Two and one-half cents per one hundred pounds on all fish salted or mild cured, except herring.

"Eighth. Fish Traps: Fixed or floating, one hundred dollars per annum, so-called dummy traps included.

"Ninth. Cold-Storage Plants: Doing a business of one hundred thousand dollars per annum or more, five hundred dollars per annum; doing a business of seventy-five thousand dollars per annum and less than one hundred thousand dollars, three hundred and seventy-five dollars per annum; doing a business of fifty thousand and less than seventy-five thousand dollars per annum, two hundred and fifty dollars per annum; doing a business of twenty-five thousand and less than fifty thousand dollars per annum, one hundred and twenty-five dollars per annum; doing a business of ten thousand dollars and less than twenty-five thousand dollars per annum, fifty dollars per annum; doing a business of four thousand, and less than ten thousand dollars per annum; twenty-five dollars per annum; doing a business of under four thousand

dollars per annum, ten dollars per annum. The 'annual business' under this section shall be considered the gross amount received for the product and for storage of produce for others.

"Tenth. Fish-Oil Works: Using Herring in whole or in part in the manufacture of fish oil; two dollars per barrel.

"Fertilizer and fish-meal plants: Manufacturing Fertilizer and Fish Meal in whole or in part from herring; two dollars per ton."

The legislature also appropriated \$80,000 for use in the construction and operation of fish hatcheries, and for the protection and care of the natural spawning grounds in the Territory, and also provided that the governor of Alaska shall appoint a board of three fish commissioners, of which he shall be a member ex officio, whose duty it shall be to direct the work of propagating fish and caring for their spawning grounds, with authority to appoint a general hatcheries superintendent who shall select the locations of hatcheries and provide a working force for each establishment. The general hatcheries superintendent is also directed to supervise spawning operations, and where it is possible to collect more eggs than the hatcheries will accommodate, to take and plant this excess quantity in the beds of rivers and creeks.

In respect to the increased license tax referred to above, the Territorial treasurer of Alaska wrote the Commissioner of Fisheries on April 10, 1918, as follows:

The purpose of the Territorial Legislature in increasing the tax rate on the several classes or varieties of canned salmon was, by agreement with the fisheries interests, to provide for a "fish-hatcheries fund;" the moneys from such fund to be available for "building and operating fish hatcheries and for the protection and care of natural spawning grounds in the Territory of Alaska." Figuring that the increase would net an additional \$40,000 per annum, both branches of the 1917 legislative assembly passed a measure which provided for the setting aside of a fund in amount of \$80,000, same to be available for expenditure for the purposes mentioned during the biennium ending March 31, 1919. However, although passed by both houses, the bill was misplaced and was not transmitted to the governor for approval until several days after adjournment; the legality, therefore, of the measure is questioned, and to date the fund provided for has not been set aside nor have any disbursements been made in this connection.

### TERRITORIAL LICENSE TAX.

Information has been received from the Territorial treasurer of Alaska in respect to tax collections made for the fiscal year ending December 31, 1917, under the several fisheries schedules of the Territorial tax law. The following is a statement of receipts as of April 9, 1918:

#### FISHERY LICENSE TAXES COLLECTED BY TERRITORY FOR THE FISCAL YEAR ENDED DEC. 31, 1917.

Schedule.	Division No. 1.	Division No. 2.	Division No. 3.	Total.
Canneries .....	\$72,657.86	\$91.58	\$111,064.45	\$183,813.89
Salteries .....	1,011.36	16.60	2,316.97	3,344.93
Fish traps .....	33,906.00	100.00	15,200.00	49,206.00
Cold-storage plants .....	1,225.00		250.00	1,475.00
Total .....	108,800.22	208.18	128,831.42	237,839.82

The Territorial treasurer advises that the above collections closely approximate the amount of taxes due for the fiscal year 1917. Under the provisions of the Territorial tax law of 1915 the total collections reported for the two years 1915 and 1916 amounted to only \$62,145.69. Thus the Territorial tax collected in 1917 is nearly four times the sum similarly collected for the two preceding years.

#### WOOD RIVER CENSUS.

A count was made in 1917 of the salmon ascending Wood River to spawn. With the exception of 1914, similar counts have been made in previous years beginning with 1908. The rack across the outlet of Lake Aleknagik, the lowermost of the Wood River series of lakes, was put in order in June. The counting of salmon began June 26 and was continued daily until August 1. The census was taken by Kenneth P. Hutton, fish-culturist at the Yes Bay station, temporarily detailed for this duty.

In this connection it may be stated that in the Bristol Bay region the salmon were several days later in arriving than in 1916, which circumstance caused the packers some concern over the probability of a light run. There was no obvious reason for the delay in the run. Although the previous winter had been exceptional in many respects, sudden freezes and high winds being followed by equally sudden thaws and heavy snows, it broke about the usual time and on June 1 Lake Aleknagik and Wood River were free from ice. And with the extreme high water in the rivers, resulting from the spring thaw, conditions were such as to presage an early appearance of the salmon.

The first large count at the Wood River rack was made July 6, when 79,707 salmon entered the lake. The largest count of the season occurred on July 11, at which time 180,683 salmon passed through the rack. The heavy run continued nine days, from July 6 to 14, the count on the last day of this period being 104,000. On the following day, July 15, only 7,706 were counted. From July 18 to 21 the run increased slightly, 72,258 being counted July 19, but thereafter it declined rapidly, and counting was discontinued August 1, which was 11 days earlier than in 1916. From July 11 to 14 a total of 529,538 salmon were counted as passing into Lake Aleknagik; this is almost equal to the number admitted during the entire season of 1916. It is probable that in proportion to the size of the run a larger number of salmon escaped the nets of the fishermen in 1917 than in the preceding season, as a result of the storms which interrupted operations during the summer.

The total count in 1917 was 1,081,508. Corresponding figures for previous years are as follows: In 1916, 551,959; in 1915, 259,341; in 1913, 753,109; in 1912, 325,264; in 1911, 354,299; in 1910, 670,104; in 1909, 893,244; and in 1908, 2,600,655. The tally of salmon at the Aleknagik rack in 1917 is shown in detail in the following table:

## WOOD RIVER SALMON CENSUS IN 1917.

Date.	Number.	Date.	Number.	Date.	Number.
June 26.....	261	July 9.....	75,635	July 22.....	5,753
27.....	480	10.....	76,150	23.....	7,029
28.....	381	11.....	180,683	24.....	4,373
29.....	10	12.....	139,431	25.....	2,104
30.....	.....	13.....	105,424	26.....	2,077
July 1.....	9	14.....	104,000	27.....	1,041
2.....	197	15.....	7,706	28.....	1,933
3.....	370	16.....	16,133	29.....	1,484
4.....	439	17.....	5,065	30.....	654
5.....	9,368	18.....	20,423	31.....	367
6.....	79,707	19.....	72,258	Aug. 1.....	111
7.....	59,735	20.....	32,963		
8.....	54,497	21.....	14,257	Total.....	1,081,508

It was reported that out of this number there were not more than 100 humpback and 30 king salmon, the run being almost entirely red salmon. It was also estimated that 20 per cent of the salmon entering the lake showed gill-net marks and injuries from other causes. This is a much higher percentage of marked salmon than was noted in 1916.

Recognition of the cooperation of the Alaska Packers Association and of the Alaska-Portland Packers' Association in the construction of rack and count of salmon is here given.

## ALEUTIAN ISLANDS RESERVATION.

The establishment of the Aleutian Islands Reservation and the details of its administration have been explained in corresponding reports on the Alaska fisheries and fur industries for previous years. No change was made in any particular in the year 1917.

The Department has continued to encourage the development of the fisheries of the reservation and has acted favorably on every application for a permit to carry on fishery operations there unless it appeared quite clearly that the proposed undertaking would not subserve the public interests. It is the policy of the Department that as far as practicable natives of the reservation shall have employment in connection with all fishery operations.

In the year 1917 the Department issued 13 new fishery permits. These permits covered operations of considerable diversity. One permit authorized whaling operations, and one the construction of a salmon cannery. Most of the other permits had reference to the salting of cod and salmon and to dealing in fresh fish.

## AFOGNAK RESERVATION.

Under the terms of the Department's order of March 21, 1912, amended February 6, 1913, commercial fishing may be carried on within the Afognak Reservation by such natives and white men married to native women as were living on Afognak Island and the smaller adjacent islands at the time of the promulgation of the order. To prevent abuses of the privilege thus granted, the Bureau has supervised each season all commercial operations and maintained a patrol of the reserved waters during the time of active fishing. Alfred Nelson, apprentice fish-culturist at the Afognak hatchery, was detailed to perform this work during the summer of 1917, under the direction of the agent in charge of the district. He was authorized

to issue the permits to those who made application for and were entitled to them. It had been the custom to issue special regulations to prevent overfishing, but on account of the great need and demand for fishery products it seemed advisable this year to waive all special regulations respecting gear and close seasons heretofore imposed, except to prohibit all operations in Afognak Bay, or Litnik Bay, as it is often called, and Pauls Bay, where the salmon were required for fish-cultural purposes.

Fifty-six natives availed themselves of the privilege to fish. They grouped themselves into gangs of from four to six men each, and early in June repaired to fishing grounds of their own selection. Fishing gear, consisting chiefly of seines, was furnished in every case except one by the Kadiak Fisheries Co.

Operations were carried on at six localities each of which, except Little Afognak, showed a larger production of fish than in 1916. There is satisfaction in noting that these streams are slowly recovering from the effects of the volcanic eruption in 1912, as evidenced by the increased production in 1917, which though somewhat under the average yield for the seasons preceding that disaster, is encouraging to the extent that from now on each season should show improvement over the preceding one until normal conditions are regained.

Little Afognak retained first place in the production of red salmon, although the catch fell off slightly more than one-third, there having been a decline from 34,898 in 1916 to 22,157 in 1917. Izhut Bay, which was reported as having produced none in 1916, took second place with a yield of 17,638 red salmon. Paramanof led in the production of humpbacks, 55,924 having been taken as against none in 1916; Danger Bay took second place with 22,581 fish of this species, and Seal Bay third with 20,342. In the order of their production of all species of salmon, Paramanof took first place, while Seal, Izhut, and Danger Bays followed in the order named, leaving Little Afognak in fifth place as against a leading position in 1916. Taking the reservation as a whole, a comparison of catches for 1916 and 1917 shows that sockeyes increased from 46,311 to 71,527, and humpbacks from 5,470 to 107,333, while cohos declined from 21,267 to 3,558. No kings or chums were taken.

It was reported that the run of sockeyes to Afognak Bay was unusually heavy, exceeding that of any year since the hatchery began operations, in consequence of which a large collection of eggs was made.

The following table shows, by localities and species, the number of salmon taken commercially from the waters of the Afognak Reservation:

CATCH OF SALMON IN THE AFOGNAK RESERVATION, SEASON OF 1917.

Localities.	Sock-eyes.	Cohos.	Hump-backs.	Total.
Malina.....	11,516	-----	1,315	12,831
Paramanof.....	13,042	185	55,924	69,151
Seal Bay.....	6,990	462	20,342	27,794
Little Afognak.....	22,157	1,496	261	23,914
Izhut Bay.....	17,638	-----	6,910	24,548
Danger Bay.....	184	1,415	22,581	24,180
Total.....	71,527	3,558	107,333	182,418



The natives were paid approximately \$4,800 for this catch of fish, all of which was sold to the Kodiak Fisheries Co., at Kodiak.

The following table indicates the method of capture of each species and the approximate beginning and ending of the fishing season in each locality:

APPARATUS AND APPROXIMATE FISHING SEASON, AFOGNAK RESERVATION, 1917.

Localities.	Seined.			Gilled: Sock- eyes.	Fishing season.	
	Sock- eyes.	Cohos.	Hump- backs.		Began.	Ended.
Malina.....	11,056	-----	1,315	460	June....	August.
Paramanof.....	12,964	185	55,924	78	..do.....	Do.
Seal Bay.....	6,990	462	20,342	-----	July.....	Do.
Little Afognak.....	21,651	1,496	261	506	June....	September.
Izhut Bay.....	17,638	-----	6,910	-----	July.....	August.
Danger Bay.....	184	1,415	22,581	-----	August..	September.
Total.....	70,483	3,558	107,333	1,044		

## ANNETTE ISLAND FISHERY RESERVE.

The Annette Island Fishery Reserve was created by a presidential proclamation dated April 28, 1916, and includes certain waters surrounding Annette Island and a number of smaller adjacent islands in southeastern Alaska. The reserve was created for the benefit of the Metlakatlangs and other Alaskan natives in residence on these islands. The use of the reserved waters for fishery purposes must be in accordance with the general fisheries laws and regulations of the United States as administered by the Secretary of Commerce. The interests of the Metlakatlangs and other natives on the islands in question are looked after by the Bureau of Education, Department of the Interior, in connection with the discharge of its general duties to the natives of Alaska.

The lease entered into by the Department of the Interior on May 4, 1916, with P. E. Harris for the operation of a cannery on Annette Island, was rendered inoperative on account of the burning of the cannery on May 17, 1916. A subsequent lease was accordingly entered into with the Annette Island Packing Co., Seattle, Wash. The new lease provides for the use of a site for a salmon cannery and for fish-trap rights. The lease runs for five years beginning with 1918. In 1917 the lessees began the construction of the proposed cannery, and canning operations are expected to begin in 1918. The lessees pay an annual permit fee of \$100 for each fish trap erected on the reserve and a royalty of 1 cent per salmon for all salmon taken in the traps. Beginning with 1918, annual payments aggregating not less than \$6,000 are guaranteed by them. As far as practicable the natives are to be employed for all fishery operations, exception being made in certain instances where skilled labor is required.

The lessees had the privilege of operating fish traps in the reserved waters in 1917. For this privilege a payment of not less than \$4,000 was guaranteed by them. According to information furnished by the Bureau of Education, six traps were operated, resulting in a take of 472,505 salmon.

The Bureau of Education expresses the hope that the money which the natives receive as the result of the lease will make it possible for them to purchase the interests of the lessees upon the termination of the five-year period and then to operate the cannery themselves under proper supervision.

### INJURY TO FISHERIES BY BIRDS.

In 1914 and 1915 E. P. Walker, inspector in the Alaska fisheries service, made some inquiries into the destruction of herring by predatory birds, particularly gulls and ducks, and reported that an enormous quantity of herring eggs was destroyed each season by these birds in the vicinity of Craig and Sitka, where large numbers of herring spawn. As a result of these observations, the Bureau gave careful consideration to the formulation of measures designed to overcome agencies destructive to the herring fishery. In the meantime a convention was made between the United States and Great Britain for the protection of migratory birds in the United States and Canada. This was signed on August 16 and proclaimed December 8, 1916.

Article I of the treaty designates the migratory birds under three classifications, (1) migratory game birds, (2) migratory insectivorous birds, and (3) other migratory nongame birds, which are the auks, auklets, bitterns, fulmars, gannets, grebes, guillemots, gulls, herons, jaegers, loons, murre, petrels, puffins, shearwaters, and terns.

Article II prescribes close seasons for these three classes of birds. Section 3 refers particularly to those of the third category indicated above. It says:

The close season on other migratory nongame birds shall continue throughout the year, except that Eskimos and Indians may take at any season auks, auklets, guillemots, murre, and puffins, and their eggs, for food and their skins for clothing, but the birds and eggs so taken shall not be sold or offered for sale.

It thus appears that gulls and terns, which are said to consume large quantities of herring, can not be killed lawfully at any time.

### THE COPPER RIVER FISHERY.

When the fishing season of 1917 opened, it was found that seven canning companies had made preparations to take salmon from the Copper River. It was also learned that there would be a large increase in the amount of fishing gear employed, all of which gave promise of intensive and perhaps exhaustive fishing of those waters. The activities in this locality in 1916 were sufficient to cause some apprehension that serious inroads into the continuing supply of salmon might be made, thus threatening the existence of a valuable fishery. Special inquiries were therefore made in order to ascertain the facts and real conditions of the fishery, that out of the knowledge thus obtained the needs of the salmon fishery of the region might be learned and measures adopted to bring about its greater protection. Accordingly James H. Lyman, assistant agent in the Alaska service, spent much of the summer of 1917 on the Copper River examining spawning grounds and observing the effect of increased operations upon the escapement of salmon. Dr. Charles H. Gilbert, of Stanford University, California, also made valuable observations in respect to the exhaustion of the fishery.

As a result of these investigations, conditions were brought to light which, in the judgment of all interested persons, required careful and serious consideration to insure the permanency of the fishery. That the Copper River was overfished was admitted by all.

It was shown that approximately 60,000 fathoms of gill nets were used in the Copper River fishery in 1917, as compared with approximately 30,000 fathoms in 1916. The greater part of this gear was operated in the waters of the delta, and the catch of salmon in that section was correspondingly increased over that of 1916. Considerably more gear was employed in Miles Lake in 1917 than in 1916, but in proportion to the total number of fathoms used the catch was much less than in 1916, thus showing conclusively the effect of extended operations about the delta. The Copper River fisheries produced 890,000 salmon of all species in 1917, as compared with 869,350 in 1916. Of the catch in 1917, 62 per cent was taken from the waters of the delta, while the remaining 38 per cent came from all sections of the river above the delta. Although the catch was slightly larger than in 1916, the run of salmon in the river was regarded as being less for the reason that an increase of 100 per cent in the amount of gear operated would, under ordinary circumstances, result in a proportionately larger catch.

The Indians of the Copper River Valley, as for a number of years past, again protested against the extensive fishing operations on the river by the canning companies, and complained that the run of salmon was so light that they could not secure a sufficient supply of fish for their summer needs, much less those of the winter. The sincerity of the Indians in thus picturing themselves as extremely destitute and reduced to the verge of starvation is open to question. It is not in evidence that they have fared worse than the Indians in many other localities who may be even less fortunately situated.

The general condition of the Copper River fisheries was not satisfactory, and the preponderance of evidence weighed against a continuance of unrestricted fishing in any of its waters. It was regarded as a problem of unusual importance and one that merited early attention. After due consideration of all phases of the matter a hearing was held at Seattle, Wash., December 14, 1917, to consider the advisability of limiting or prohibiting fishing in the waters of the Copper River. It was attended by representatives of all the canning companies operating in the Copper River district, and a general discussion of the entire subject ensued. Various plans were proposed and discussed, and much information of value was adduced. As a result of this hearing, an order was promulgated on December 29, 1917, restricting in several ways commercial fishing in the Copper River and the waters of its delta. This order became effective January 1, 1918. The order appears in full elsewhere in this document.

### **SALMON HATCHERIES.**

#### **EXTENT OF OPERATIONS.**

In 1917 fish-cultural operations were carried on at six hatcheries in Alaska—two operated by the Government and four by private interests. At one of the private hatcheries, namely, Klawak, operations were continued only to the extent of releasing the young salmon

from eggs taken in the fall of 1916. Two substations were operated in conjunction with the Afognak hatchery, one at Seal Bay and the other at Uganik. The annual capacity of the above-indicated hatcheries is approximately 303,000,000 red-salmon eggs, of which the two Government stations can handle 150,000,000.

In 1916 the total take of red or sockeye salmon eggs in Alaska was 171,542,000. In the corresponding report of Alaska Fisheries and Fur Industries for 1916 this number was stated to be 171,566,000, which was in error because of an incorrect report made by one of the private hatcheries. The number of red or sockeye salmon liberated in Alaskan waters in the season of 1916-17 was 155,641,000, as compared with 142,964,140 in the previous season. The take of red-salmon eggs in 1917 aggregated 115,964,000, or 55,578,000 less than in 1916. This great decrease is due in part to the closure of the Karluk hatchery and the failure to take eggs at Klawak, but results principally from the smaller take of eggs at the Fortmann hatchery, where only 6,840,000 were taken, as compared with 62,580,000 in 1916. The take of eggs at the Yes Bay and Quadra hatcheries was slightly smaller than in 1916, while at Hetta it was somewhat larger. The take at Afognak was approximately three times as large as in 1916. Collections of humpback-salmon eggs were made at Uganik and Seal Bay, which were transferred to Afognak.

#### OPERATIONS OF ALASKA HATCHERIES IN 1917.

Stations.	Red or sock-eye salmon eggs taken in 1916.	Red or sock-eye salmon liberated in 1916-17.	Red or sock-eye salmon eggs taken in 1917
Yes Bay.....	58,000,000	a 51,175,000	34,950,000
Afognak.....	17,044,000	b 21,116,000	c 53,036,000
Uganik.....	692,000	(d)	
Seal Bay.....	4,678,000		e 2,712,000
Karluk.....	1,016,000		
Fortmann (Naha Stream).....	62,580,000	57,405,000	f 6,840,000
Quadra.....	16,125,000	15,003,000	13,600,000
Hetta.....	g 3,247,000	3,120,000	4,826,000
Klawak.....	8,160,000	7,822,000	(h)
Total.....	171,542,000	155,641,000	115,964,000

a 2,000,000 eyed eggs were transferred to the Oregon Fish Commission at Bonneville in October, 1916.

b Includes young salmon resulting from eggs received from Uganik, Seal Bay, and Karluk.

c 300,000 humpback-salmon eggs were also taken.

d 1,253,000 humpback-salmon eggs were taken.

e 2,560,000 humpback-salmon eggs were also taken.

f 2,400,000 humpback-salmon eggs were also taken.

g Incorrectly reported previously by the company as 3,271,000, which figures appeared in the Alaska Fisheries Report for 1916.

h No eggs were taken at Klawak in 1917.

NOTE.—Of the collections of red-salmon eggs at Afognak, shipments were made in November, 1917, as follows: Dominion Fisheries Department, Agassiz, British Columbia, 10,000,000; Bureau of Fisheries station, Quinault, Wash., 5,000,000, and Oregon Fish Commission, Bonneville, 3,000,000.

#### HATCHERY REBATES.

Under the Federal law operators of private hatcheries in Alaska are entitled to a rebate of 40 cents for every thousand red or king salmon fry released. This is the equivalent of the license tax imposed by the Government on 10 cases of canned salmon. It has been recommended from time to time to Congress that steps be taken to discontinue this system and that in lieu thereof all hatcheries in Alaska be operated by the Government. Under the law, operators of private hatcheries

in Alaska are required to make affidavit of the number of salmon fry released in each fiscal year ended June 30. The following table sets forth the rebates due for the fiscal year ending June 30, 1917:

REBATES CREDITED TO PRIVATE SALMON HATCHERIES DURING THE FISCAL YEAR  
ENDED JUNE 30, 1917.<sup>a</sup>

Owners.	Location.	Red-salmon fry liberated.	Rebate due.
Alaska Packers Association.....	Naha Stream.....	57,405,000	\$22,962.00
Northwestern Fisheries Co.....	Quadra Lake.....	15,003,000	6,001.20
Do.....	Hetta Lake.....	3,120,000	1,248.00
North Pacific Trading & Packing Co.....	Klawak Lake.....	7,822,000	3,128.80
Total.....		83,350,000	33,340.00

<sup>a</sup> In the case of hatcheries where the seasonal distribution of fry is not completed before July 1, the remaining fry are shown in the subsequent fiscal year's report.

#### HATCHERY INSPECTION.

Inspections in respect to the operations of private hatcheries in Alaska were conducted as usual by representatives of the Bureau. In a general way, operations were conducted along satisfactory lines. Additional facilities for rearing salmon fry are required at practically all of the hatcheries in Alaska.

#### HATCHERY OPERATIONS.

##### YES BAY.

Between September 1 and October 2, 1916, at which latter date egg taking ceased at Yes Bay, a total of 58,000,000 red-salmon eggs were secured. In October of that year 2,000,000 eyed eggs were transferred to the station of the Oregon Fish Commission at Bonneville. Hatching was completed at Yes Bay on April 15, 1917. In the period from December 18, 1916, to August 3, 1917, there were 51,175,000 young salmon released. These plants consisted of 49,600,000 fry and 1,575,000 fingerlings. They were deposited in Yes River, Hatchery Creek, and Lake McDonald. The losses were: Eggs, 4,691,000; fry, 129,000; and fingerlings, 5,000; a total loss at Yes Bay of 4,825,000, or 8½ per cent. On account of inadequate facilities for holding fry to the free-swimming stage, many were liberated in the sac stage. Feeding on salt salmon began in June and continued until the supply was exhausted.

Egg taking in 1917 began on September 11 and ended September 26, during which period 34,950,000 red-salmon eggs were taken.

A patrol of Yes Bay was maintained as in seasons past to prevent commercial fishing in waters frequented by salmon headed for the hatchery stream.

##### AFOGNAK.

In 1916 the take of red-salmon eggs at Afognak was 17,044,000. This collection was augmented by the transfer of 681,000 eyed eggs from Uganik, 4,600,000 from Seal Bay, and 1,016,000 from Karluk. From this total of 23,341,000 there were planted in the period from October, 1916, to July, 1917 10,956,000 fry and 10,160,000 red-salmon fingerlings, a total of 21,116,000 young salmon. The loss of eggs and fry was 2,225,000, or approximately 9½ per cent.

In 1917 the red-salmon spawning season began on July 30 and ended September 11, in which period 53,036,000 red-salmon eggs were taken. In November, 18,000,000 eyed red-salmon eggs were shipped from Afognak to Seattle, and thence distributed as follows: Dominion Fisheries Department, Agassiz, British Columbia, 10,000,000; Bureau of Fisheries station, Quinault, Wash., 5,000,000; and Oregon Fish Commission, Bonneville, 3,000,000.

In the period from September 1 to 8, 1917, there was a take of 300,000 humpback eggs at Afognak. This take was augmented by the humpback eggs transferred from the Seal Bay and the Uganik substations.

#### UGANIK.

At Uganik a substation of the Afognak hatchery was operated. In 1917 no red-salmon eggs were collected, but 1,253,000 humpback eggs were taken in the period from August 14 to September 16. The resulting eyed eggs were transferred to Afognak.

#### SEAL BAY.

Field station operations at Seal Bay were auxiliary to hatchery work at Afognak. In 1917 the taking of red-salmon eggs at Seal Bay began August 8 and ended August 29, a total of 2,712,000 being secured. These eggs were held until eyed and then planted September 14 and 17 in Little Seal Bay Creek.

Humpback eggs to the number of 2,560,000 were obtained between August 24 and September 14, 1917. On October 17 a plant of humpback eggs was made in the lake and stream at Seal Bay. The remaining humpback eggs resulting from the collection at this place were transferred to Afognak.

#### FORTMANN.

The Fortmann hatchery is operated on Heckman Lake, near Loring, Alaska, by the Alaska Packers Association. It is the largest hatchery in Alaska, having a capacity of approximately 110,000,000 red-salmon eggs. Operations in 1917 were the most unsatisfactory since the beginning of activities in 1901, only 6,840,000 red-salmon eggs being secured. It is reported that this small take was due in great measure to the excessive rainfall of more than 100 inches between July 1 and November 30, which made it almost impossible to obtain spawning fish. Egg-taking operations in 1917 extended from September 3 to October 20.

From the 62,580,000 red-salmon eggs taken in the period from August 22 to November 10, 1916, there were planted 57,405,000 fry. The loss was 5,175,000, or 8.27 per cent.

In 1917, from September 3 to October 9, a take of 2,400,000 humpback-salmon eggs was made for experimental purposes.

#### QUADRA.

This hatchery is located near Quadra, in southeastern Alaska, and is owned and operated by the Northwestern Fisheries Co. Its capacity is about 21,000,000 red-salmon eggs. In 1916 the taking of eggs began August 9 and ended November 19. The total take was 16,125,000. Between November 27, 1916, and June 30, 1917,

there were liberated 15,003,000 young red salmon. The loss was 1,122,000 eggs, or 6.9 per cent.

In 1917 the taking of red-salmon eggs began August 13 and ended November 3. The total take was 13,600,000.

## HETTA.

This hatchery is also owned and operated by the Northwestern Fisheries Co. It is located on Hetta Lake, in southeastern Alaska. Its capacity is about 12,000,000 red-salmon eggs. In 1916 the take of red-salmon eggs between August 21 and December 21 was 3,247,000. The take of eggs in 1916 was erroneously reported by the company as 3,271,000, which figures were published in the corresponding report for 1916. In the period between August 21, 1916, and June 30, 1917, there were liberated 3,120,000 young red salmon. The loss was 127,000, or 3.9 per cent.

In 1917 the taking of red-salmon eggs began August 15 and ended December 14, during which period 4,826,000 were obtained.

## KLAWAK.

The Klawak hatchery is operated by the North Pacific Trading & Packing Co., and is located on a lake a few miles above Klawak, in southeastern Alaska. Its capacity is approximately 10,000,000 red-salmon eggs. In 1916 the total take of eggs was 8,160,000, obtained in the period from July 20 to September 26. From these there were liberated 7,822,000 red-salmon fry between September 26, 1916, and February 16, 1917. The loss was, therefore, 338,000, or 4.14 per cent. This hatchery was not operated in the egg-collecting season of 1917, the company reporting that it was unable to find a competent man to take charge of operations.

## GENERAL STATISTICS OF THE FISHERIES IN 1917.

The total investment in the Alaska fisheries in 1917 was \$54,937,549, an increase of \$15,367,937 over 1916. Approximately 88 per cent of this investment was in the salmon industry. The number of persons engaged in 1917 was 29,491, an increase of 5,497 over 1916. The total value of the products in 1917 was \$51,466,980, an increase of \$25,310,421 over 1916. This is an increase of more than 96 per cent in the value of the products of the Alaska fisheries. It was due in part to an increased pack of nearly all kinds of fish, but more especially to a tremendous advance in the market price of canned salmon, chums being 84 per cent higher per dozen 1-pound cans than in 1916; cohos, 64 per cent; pinks, 76 per cent; kings, 94 per cent; and reds, 56 per cent higher.

## SUMMARY OF INVESTMENTS IN THE FISHERIES OF ALASKA IN 1917.

Industries.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Salmon canning.....	\$19,929,055	\$9,412,791	\$17,523,425	\$46,865,271
Salmon mild-curing.....	940,937			940,937
Salmon pickling.....	199,734	200,688	465,020	865,442
Salmon, fresh.....	81,579			81,579
Herring fishery.....	320,087	223,670	18,245	562,002
Halibut fishery.....	2,200,987			2,200,987
Cod fishery.....		516,536	891,729	1,408,265
Whale fishery.....	828,495	39,935	741,496	1,609,926
Clam canning.....		294,987		294,987
By-products.....	108,153			108,153
Total.....	24,609,027	10,688,607	19,639,915	54,937,549

## SUMMARY OF PERSONS ENGAGED IN THE FISHERIES OF ALASKA IN 1917

Races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Whites.....	7,494	2,768	5,781	16,043
Natives.....	4,281	993	896	6,170
Japanese.....	784	354	505	1,643
Chinese.....	1,075	497	702	2,274
Mexicans.....	347	146	1,054	1,547
Miscellaneous a.....	668	318	823	1,814
Total.....	14,649	5,076	9,766	29,491

a Filipinos, Negroes, Porto Ricans, etc.

## SUMMARY OF PRODUCTS OF THE ALASKA FISHERIES IN 1917.

Products.	Quantity.	Value.	Products.	Quantity.	Value.
Salmon:			Whale oil.....galls..	900,883	\$438,362
Canned.....cases..	5,947,286	\$46,304,090	Sperm oil.....do.....	197,670	149,270
Mild-cured.....lbs..	2,850,400	344,028	Whale fertilizer.....lbs..	1,980,600	61,720
Pickled.....bbls..	36,390	590,497	Whalebone.....do.....	14,866	5,500
Fresh.....lbs.....	4,559,785	404,048	Trout:		
Frozen.....do.....	1,282,182	81,574	Frozen.....do.....	7,798	701
Dry-salted, dried, and smoked.....lbs..	377,000	53,844	Pickled.....do.....	34,800	1,899
Halibut:			Fresh.....do.....	35,168	3,317
Fresh.....do.....	7,038,283	605,205	Canned.....cases..	1,408	10,979
Frozen.....do.....	6,115,128	515,021	Sablefish.....lbs.....	1,020,490	38,303
Cod.....do.....	13,777,470	744,976	Red rockfish.....do.....	150,453	3,696
Herring:			Miscellaneous fresh fish,.....lbs..	114,167	2,247
Canned.....cases..	49,245	326,522	Clams.....cases.....	74,515	274,036
Fresh and frozen for food.....lbs..	23,082	907	Shrimps.....lbs.....	65,000	3,400
Fresh and frozen for bait.....lbs..	6,089,780	57,556	Crabs.....do.....	410	665
Pickled for food.....do.....	4,593,025	248,299	By-products, oil.....galls..	25,150	19,560
Dry-salted for food,.....lbs..	165,000	11,349	By-products, fertilizer and meal.....lbs..	1,642,000	42,313
Smoked for food.....do.....	21,600		Total.....		51,466,980
Oil.....galls.....	205,992	82,396			
Fertilizer.....tons..	1,037	40,000			

## SALMON INDUSTRY.

The salmon industry of Alaska in 1917 made tremendous gains over that of any previous season, exceeding all records in respect to the size and value of the pack. This increased production was due in part to the larger number of plants in operation, and also to the very heavy run of pink salmon in southeastern Alaska. That a material advance in value of products would result from the unusual demands of the times was not unexpected, but probably no one was prepared to witness such extraordinary increases in value of products, particularly canned salmon, as to almost double the high figures of 1916.

Southeastern Alaska contributed more than a million cases of salmon over its production of the preceding season, the increase consisting chiefly of humpbacks. The main body of salmon was later than usual in making its appearance, and some concern was felt among packers lest the season be a short one. These fears were dispelled, however, when a late but heavy run of humpback salmon entered Icy and Chatham Straits, thus enabling all canneries to make good packs, while in some instances records were broken. The number of canneries in this district was increased by nine, including two that formerly packed herring only.



The industry showed a gain of seven salmon canneries in central Alaska, several of which were located on Prince William Sound, but notwithstanding this increase in the number of plants the pack was less than in 1916, though of considerably greater value. The decline was due primarily to the comparatively small run of humpback salmon, although there was a falling off in the run of red salmon in the Cook Inlet district. Karluk and Alitak were again conspicuous in that they showed even better runs of red salmon than in 1916, which was then considered an exceptional year.

Western Alaska showed a pack of red salmon slightly larger than in 1916, even though there was a great falling off in the catch in the Port Moller region where five canneries were operated as against three in the preceding season. The entire pack of the five plants was less than that made at the Port Moller cannery alone in 1916. This is the only district in western Alaska where salmon are taken by purse seines, the chief fishing ground being off the mouth of Bear River. Opinions do not agree as to the ultimate destination of these salmon taken near Port Moller, since some observers hold that the run is local and destined to the Bear River lakes, while others maintain that it is a part of the run to Bristol Bay. No definite conclusion may be stated in respect to these opinions. It would seem, however, that the opinion that the run is local is probably correct, as at no other region between Unimak Island and the Ugashik River have salmon been obtained commercially, except in the Port Heiden field, where a few barrels have been pickled. If the salmon ordinarily taken in the Port Moller district are a part of the Bristol Bay fish deflected from their course by the currents of fresh water from the rivers near Port Moller, the small catch in that district may be easily explained by assuming that the main body of fish was not deflected in 1917 but held offshore and continued on its way toward the head of the bay. Perhaps also the almost incessant westerly winds prevailing during the time of the run may have influenced the movements of the salmon.

The catch of red salmon in western Alaska in 1917 was the largest that has ever been made, aggregating more than 24,000,000 fish and exceeding by 2,500,000 the highest previous figures, those of 1914.

#### SALMON CATCH AND FORMS OF GEAR.

As in previous years, gear used in the salmon fisheries of Alaska consisted chiefly of beach and purse seines, and gill and pound nets. There were 599 seines in operation, the total length of which was 98,520 fathoms. The gain in this form of apparatus over 1916 was 165, southeast Alaska being credited with an increase of 72, central Alaska with 84, and western Alaska with 9 additional seines.

Gill nets used in the salmon industry numbered 5,113 and measured in the aggregate 493,554 fathoms. They were divided among the three districts as follows: Southeast Alaska, 428 gill nets, a decrease from the number reported in 1916 of 132; central Alaska, 1,149, a gain of 644; and western Alaska, 3,536, an increase of 1,550. This is a net increase of 2,062 gill nets over 1916.

Two kinds of pound nets or traps were in use, floating and driven, there being 72 of the former and 398 of the latter, a total of 470. This is an increase of 97 over 1916. Of the number operated in 1917,

southeast Alaska had 72 floating and 243 driven, gains of 5 and 55, respectively; central Alaska had 136 driven pound nets, a gain of 42 over 1916, the increase being largely due to the operation of two new canneries in the western part of the district; and western Alaska had 19 driven pound nets as against 24 in 1916, a decrease of 5.

Taking Alaska as a whole, there was an increase of 31 per cent in the number of fathoms of seines operated in the salmon industry in 1916; the number of fathoms of gill nets employed increased 19 per cent; and pound nets increased 26 per cent in number.

Of the total catch of salmon in Alaska in 1917, 39 per cent was taken by pound nets, 32 per cent by seines, 28 per cent by gill nets, and 1 per cent by lines and dip nets. In 1916, seines caught 36 per cent of the salmon taken in Alaska, pound nets 33 per cent, gill nets 30 per cent, while other appliances caught the remaining 1 per cent. The catch by pound nets in 1917 increased 6 per cent, but the catch by seines and gill nets decreased 4 and 2 per cent, respectively. The following table shows the proportionate catch by districts according to the principal kinds of apparatus used:

PERCENTAGE OF SALMON CAUGHT IN EACH DISTRICT BY PRINCIPAL FORMS OF GEAR.

Apparatus.	Southeast Alaska.		Central Alaska.		Western Alaska.	
	1916	1917	1916	1917	1916	1917
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Seines.....	43	41	58	48	7	2
Pound nets.....	52	55	35	38	7	4
Gill nets.....	3	2	6	12	85	94

Alaska produced a total of 92,600,495 salmon in 1917 as against 72,055,971 in 1916, an increase of 20,544,524. There was an increase of 22,482,783 salmon in southeast Alaska and 1,605,605 in western Alaska, but central Alaska declined 4,306,439. Further comparison of the catch of Alaska as a whole with that of 1916 shows that chums increased 1,147,864, humpbacks 13,067,308, and reds 6,763,804. Cohos declined 350,078, and kings 84,674.

As of further interest in this connection, it may be stated that a total of 599 seines used in the salmon fisheries of Alaska took 29,381,979 salmon, an average of 49,052 per seine; a total of 470 pound nets used in the same fisheries caught 36,091,649 salmon, an average of 76,790 per pound net. The relative efficiency of the two forms of gear was at the ratio of 5 to 8 in favor of pound nets.

## SALMON TAKEN IN 1917, BY SPECIES AND APPARATUS, FOR EACH GEOGRAPHIC SECTION OF ALASKA.

Apparatus and species.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
<b>Seines:</b>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
Coho, or silver.....	305,471	50,057	7,169	362,697
Chum, or keta.....	4,465,627	567,336	61,648	5,094,611
Humpback, or pink.....	16,506,787	2,561,677	612	19,069,076
King, or spring.....	6,461	1,562	6,705	14,728
Red, or sockeye.....	871,434	3,574,225	395,208	4,840,867
Total.....	22,155,780	6,754,857	471,342	29,381,979
<b>Gill nets:</b>				
Coho, or silver.....	321,860	229,836	73,733	625,429
Chum, or keta.....	108,376	77,587	336,708	522,671
Humpback, or pink.....	210,335	140,231	40,522	391,088
King, or spring.....	31,777	35,215	95,123	162,115
Red, or sockeye.....	535,912	1,251,376	22,822,194	24,609,482
Total.....	1,208,260	1,734,245	23,368,280	26,310,785
<b>Pound nets:</b>				
Coho, or silver.....	678,642	84,030	930	763,602
Chum, or keta.....	2,429,939	355,870	124,289	2,910,098
Humpback, or pink.....	25,190,370	209,964	560	25,400,894
King, or spring.....	36,757	37,489	14,576	88,822
Red, or sockeye.....	1,322,005	4,618,346	987,882	6,928,233
Total.....	29,657,713	5,305,699	1,128,237	36,091,649
<b>Lines:</b>				
Coho, or silver.....	343,758			343,758
Chum, or keta.....	198			198
Humpback, or pink.....	14,213			14,213
King, or spring.....	326,538			326,538
Red, or sockeye.....	41,475			41,475
Total.....	726,182			726,182
<b>Dip nets:</b>				
Coho, or silver.....		8,767		8,767
King, or spring.....		4,143		4,143
Red, or sockeye.....		76,990		76,990
Total.....		89,900		89,900
<b>Total:</b>				
Coho, or silver.....	1,649,731	372,690	81,832	2,104,253
Chum, or keta.....	7,004,140	1,000,793	522,645	8,527,578
Humpback, or pink.....	41,921,705	2,911,872	41,694	44,875,271
King, or spring.....	401,533	78,409	116,404	596,346
Red, or sockeye.....	2,770,826	9,520,937	24,205,284	36,497,047
Grand total.....	53,747,935	13,884,701	24,967,859	92,600,495

## CATCH OF SALMON IN BRISTOL BAY WATERS.

Request has been received from commercial fishery interests for a compilation of the catch of salmon in the important Bristol Bay region of Alaska. Broadly speaking, about one-third of the yield of salmon from Alaskan waters comes from this region. The following table shows the catches made in the more important waters fished in the Bristol Bay district in the period of five years from 1913 to 1917.

## SALMON IN THE COMMERCIAL CATCH, BRISTOL BAY REGION, 1913 TO 1917.

Species and stream.	1913	1914	1915	1916	1917	Total.
<b>Red salmon:</b>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
Nushagak.....	5,236,008	6,174,097	5,676,457	3,592,574	5,679,818	26,358,954
Igushik.....	173,925	283,718	228,405	223,343	167,421	1,076,812
Kvichak-Naknek.....	13,691,050	12,584,809	7,156,488	11,551,086	15,762,582	60,746,015
Ugagak.....	902,728	897,767	1,216,252	1,578,862	1,856,600	6,452,209
Ugashik.....	577,615	254,716	509,076	647,422	1,047,111	3,035,940
Total.....	20,581,326	20,195,107	14,786,678	17,593,287	24,513,532	97,669,930
<b>King salmon:</b>						
Nushagak.....	67,622	89,599	116,281	81,591	73,839	428,932
Igushik.....	34	94	106	330	477	1,041
Kvichak-Naknek.....	5,648	10,657	29,392	20,934	16,155	82,786
Ugagak.....	254	405	510	365	143	1,677
Ugashik.....	691	1,209	1,739	1,904	531	6,074
Total.....	74,249	101,964	148,028	105,124	91,145	520,510
<b>Coho salmon:</b>						
Nushagak.....	66,640	81,434	117,172	293,210	62,260	620,716
Kvichak-Naknek.....	2	17,462	13,271	288	3	31,026
Ugagak.....	165	165				330
Total.....	66,807	99,061	130,443	293,498	62,263	652,072
<b>Pink and chum salmon:</b>						
Nushagak.....	683,201	932,477	444,146	1,818,566	303,437	4,181,827
Igushik.....				738	183	921
Kvichak-Naknek.....	13,940	173,831	232,082	304,117	83,019	806,989
Ugagak.....	7,450	7,450	12,004	7,500	5,726	40,130
Ugashik.....	14,704	14,613	18,212	49,196	879	97,604
Total.....	719,295	1,128,371	706,444	2,180,117	393,244	5,127,471
<b>Grand total.....</b>	<b>21,441,677</b>	<b>21,524,503</b>	<b>15,771,593</b>	<b>20,172,026</b>	<b>25,060,184</b>	<b>103,969,983</b>

## SALMON CANNING.

## NEW CANNERIES.

In 1917 there were 18 more salmon canneries in operation in Alaska than in 1916. Of this number nine were in southeast Alaska, seven in central, and two in western Alaska. Those in the southeastern district were operated as follows: Alaska Herring & Sardine Co., Port Walter; Alaska Pacific Herring Co., Big Port Walter; Baranof Packing Co., Red Bluff Bay; R. L. Cole & Co., Token; Haines Packing Co., Letinkof Cove; Lane & Williams, Moira Sound; Northland Fish Co. (floating plant), Metlakatla; Sitka Packing Co., Sitka; and Robert Scott, a floating cannery at Craig. The central district shows the following: Copper River Packing Co., Port Nellie Juan; Lighthouse Canning Co., Cordova; Moore Packing Co., Cordova; Northwestern Fisheries Co., Kenai; Pacific American Fisheries, Ikatan; San Juan Fishing & Packing Co., Seward; Sockeye Salmon Co., Morzhovoi Bay; and Valdez Packing Co., Valdez. Those in western Alaska were the Fidalgo Island Packing Co. and the Phoenix Packing Co., both at Herendeen Bay.

Included in the above list are three canneries that operated in 1916, but were not then engaged in salmon canning, namely, those of the Alaska Herring & Sardine Co., the Alaska Pacific Herring Co., and the Lighthouse Canning Co.

## CHANGES IN CANNERIES.

In December, 1916, the Lindenberger Packing Co. relinquished its cannery interests in Alaska by selling the Roe Point plant to the Northwestern Fisheries Co. and transferring the Craig plant to the Columbia Salmon Co., which latter concern also sold its cannery at Seldovia to the Northwestern Fisheries Co. It is reported that the Seattle Packing Co. retired from the fishery business in Alaska by the sale of the barge *Amelia*, used as a cannery in 1916, to the Northland Fish Co., which operated it at Metlakatla. The Sanitary Packing Co. became the Ketchikan Packing Co., which continued the operation of the plant at Ketchikan. In the fall of 1916 the Sunny Point Packing Co. took over all the interests of the Northland Packing Co., and operated the cannery also located at Ketchikan. The Canoe Pass Packing Co. built a cannery at Sugar Point, near Cordova, and moved thereto the machinery previously used in the leased quarters on the Cordova dock.

The canneries formerly listed in the name of the Alaska Fishermen's Packing Co., North Alaska Salmon Co., and the Yakutat & Southern Railway Co. are now shown under the name of Libby, McNeill & Libby.

## CANNERIES OPERATED IN 1917.

In 1917 there were 118 salmon canneries in operation in Alaska 62 of which were in southeast Alaska, 27 in central Alaska, and 29 in western Alaska.

COMPANIES CANNING SALMON IN ALASKA, NUMBER AND LOCATION OF CANNERIES OPERATED, AND NUMBER OF POUND NETS OWNED BY EACH.

Name.	Canneries.	Location.	Pound nets.
<b>Southeast Alaska:</b>			
Alaska Fish Co.....	1	Waterfall.....	2
Alaska Herring & Sardine Co.....	1	Port Walter.....	a1
		Chilkoot.....	b12
Alaska Pacific Fisheries.....	3	Chomly.....	c9
		Yes Bay.....	d13
Alaska Pacific Herring Co.....	1	Big Port Walter.....	
Alaska Packers Association.....	2	Loring.....	e11
		Wrangell.....	f7
Alaska Sanitary Packing Co.....	1	do.....	5
Anacortes Fisheries Co.....	2	Kasaan.....	7
		Shakan.....	3
Astoria & Puget Sound Canning Co.....	1	Excursion Inlet.....	8
Auk Bay Salmon Canning Co.....	1	Auk Bay.....	4
Baranof Packing Co.....	1	Red Bluff Bay.....	
Barnes, F. C., Co.....	1	Lake Bay.....	3
Beegle Packing Co.....	1	Ketchikan.....	3
Cole, R. L., & Co.....	1	Tokeen.....	
Columbia Salmon Co.....	1	Craig.....	4
Deep Sea Salmon Co.....	1	Ford Arm.....	a10
Doyhof Fish Products Co.....	1	Scow Bay.....	e2
Fidalgo Island Packing Co.....	1	Ketchikan.....	7
George Inlet Packing Co.....	1	George Inlet.....	1½
Haines Packing Co.....	1	Letinkof Cove.....	
Harris, P. E., & Co.....	1	Hawk Inlet.....	12
Hidden Inlet Canning Co.....	1	Hidden Inlet.....	e2
Hoonah Packing Co.....	2	Gambler Bay.....	5
		Hoonah.....	13
Hume, G. W., Co.....	1	Nakat Harbor.....	e1
Karheen Packing Co.....	1	Karheen.....	5
Ketchikan Packing Co.....	1	Ketchikan.....	
Lane & Williams.....	1	Moira Sound.....	
Libby, McNeill & Libby.....	1	Yakutat.....	
Myers, Geo. T., & Co.....	1	Chatham.....	7
Northland Fish Co.....	1	Metlakatla.....	2
a All floating.	c 4 floating.	e 6 floating.	g 1 floating.
b 2 floating.	d 9 floating.	f 5 floating.	

## COMPANIES CANNING SALMON IN ALASKA, NUMBER AND LOCATION OF CANNERIES OPERATED, AND NUMBER OF POUND NETS OWNED BY EACH—Contd.

Name.	Canneries.	Location.	Pound nets.
Southeast Alaska—Continued.			
North Pacific Trading & Packing Co. ....	1	Klawak .....	
		Dundas Bay .....	a9
		Hunter Bay .....	b2
Northwestern Fisheries Co. ....	5	Quadra .....	4
		Roe Point .....	c7
		Santa Ana .....	b1
Pacific American Fisheries .....	1	Excursion Inlet .....	18
Petersburg Packing Co. ....	1	Petersburg .....	3
Pillar Bay Packing Co. ....	1	Pillar Bay .....	4
Point Warde Packing Co. ....	1	Point Warde .....	
Pure Food Fish Co. ....	1	Ketchikan .....	d4
Sanborn-Cram Co. ....	1	Burnett Inlet .....	b4
Sanborn-Cutting Co. ....	1	Kake .....	b6
Scott, Robert .....	1	Craig .....	
Sitka Packing Co. ....	1	Sitka .....	
Smiley, J. L., & Co. ....	1	Ketchikan .....	3
Starr-Collinson Packing Co. ....	1	Moir Sound .....	c6
Straits Packing Co. ....	1	Skowl Arm .....	1
Sunny Point Packing Co. ....	2	Ketchikan .....	d5
		Sunny Point .....	
Swift-Arthur-Crosby Co. ....	1	Heceta Island .....	
Taku Canning & Cold Storage Co. ....	1	Taku Harbor .....	15
Tee Harbor Packing Co. ....	1	Tee Harbor .....	9
Tenakee Fisheries Co. ....	1	Tenakee .....	4
Thlinket Packing Co. ....	1	Funter Bay .....	23
Union Bay Fisheries Co. ....	1	Union Bay .....	3
Ward's Cove Packing Co. ....	1	Ward Cove .....	1
Wiese Packing Co. ....	1	Rose Inlet .....	3
Central Alaska:			
Alaska Packers Association .....	4	Alitak .....	2
		Chignik .....	3
		Kasilof .....	14
		Larsen Bay .....	
Canoe Pass Packing Co. ....	1	Cordova .....	3
Carlisle Packing Co. ....	1	do .....	3
Clark-Graham Co. ....	1	Eyak River .....	
Columbia River Packers' Association .....	1	Chignik .....	6
Copper River Packing Co. ....	2	Abercrombie .....	
		Port Nellie Juan .....	
Deep Sea Salmon Co. ....	1	Knik Arm .....	6
Fidalgo Island Packing Co. ....	1	Port Graham .....	6
Hoonah Packing Co. ....	1	Katalla .....	
Kadiak Fisheries Co. ....	1	Kodiak .....	1
Libby, McNeill & Libby .....	1	Kenai .....	16
Lighthouse Canning Co. ....	1	Cordova .....	
Moore Packing Co. ....	1	do .....	
		Chignik .....	3
		Kenai .....	14
Northwestern Fisheries Co. ....	5	Orca .....	
		Seldovia .....	6
		Uyak .....	
Pacific American Fisheries .....	2	Ikatan .....	13
		King Cove .....	12
San Juan Fishing & Packing Co. ....	1	Seward .....	
Sockeye Salmon Co. ....	1	Morzhovoi Bay .....	4
Valdez Packing Co. ....	1	Valdez .....	1
Western Alaska:			
Alaska Packers Association .....	8	Kvichak River (2) .....	1
		Naknek River (3) .....	
		Nushagak Bay (2) .....	4
		Ugagak River .....	
Alaska-Portland Packers' Association .....	1	Nushagak Bay .....	3
Alaska Salmon Co. ....	1	Wood River .....	
Bering Sea Packing Co. ....	1	Herendeen Bay .....	1
Bristol Bay Packing Co. ....	1	Kvichak Bay .....	
Columbia River Packers' Association .....	1	Nushagak Bay .....	
Fidalgo Island Packing Co. ....	1	Herendeen Bay .....	
		Nushagak Bay (2) .....	
Libby, McNeill & Libby .....	6	Koggiung .....	
		Kvichak River (2) .....	
		Ugagak River .....	
Midnight Sun Packing Co. ....	1	Kotzebue .....	1
Naknek Packing Co. ....	1	Naknek River .....	
Nelson Lagoon Packing Co. ....	1	Nelson Lagoon .....	5
Northwestern Fisheries Co. ....	1	Nushagak .....	
Pacific American Fisheries .....	2	Makushin Bay .....	
Phoenix Packing Co. ....	1	Port Moller .....	5
Red Salmon Canning Co. ....	2	Herendeen Bay .....	
		Naknek .....	
		Ugashik River .....	

a 3 floating.  
b All floating.

c 2 floating.  
d 1 floating.

e 5 floating.

## STATISTICS.

The number of canneries in operation in Alaska in 1917 was 118, as compared with 100 in 1916. The total investment was \$46,865,271, an increase of \$12,764,418 over 1916. The investment in southeast Alaska increased \$7,198,635, in central Alaska \$3,086,762, and in western Alaska \$2,479,003.

The number of persons employed in the salmon-canning industry in 1917 was 23,350, an increase of 4,110 over 1916, when 19,240 were employed. Whites increased 2,823 and natives 767. Chinese decreased 97, Japanese 183, and miscellaneous 735. The decrease in miscellaneous persons employed is due to the fact that the Mexicans, which formerly were included in that category, are given separate classification in the list for 1917.

There were packed in Alaska in 1917 a total of 5,947,286 cases of salmon, valued at \$46,295,900. This is an increase of 1,046,559 over the 4,900,627 cases packed in 1916 and an increase of \$23,034,661 over the value of the 1916 pack, which was \$23,269,429. The pack in 1917 establishes a new record in the production of the salmon fisheries, exceeding by long odds the pack of previous years in both quantity and value. Taking each section separately, the pack was as follows: Southeast Alaska advanced from 2,214,280 cases to 3,294,851, an increase of 1,080,571 cases; central Alaska declined from 1,075,913 to 1,017,206 cases, a falling off of 58,707 cases; and western Alaska increased from 1,610,434 to 1,635,235 cases, a gain of 24,801 cases over the pack of 1916. A comparison by species shows that chums increased from 724,115 to 906,747 cases, a gain of 182,632 cases; humpbacks increased from 1,737,793 to 2,296,976 cases, a gain of 559,183 cases; and reds increased from 2,110,937 to 2,488,381 cases, an advance of 377,444 cases. Cohos declined from 261,909 to 193,231 cases, a decrease of 68,678 cases, and kings fell off from 65,873 to 61,951 cases, a decrease of 3,922 cases in 1917.

## INVESTMENT IN THE SALMON-CANNING INDUSTRY IN 1917.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Canneries operated.....	62	\$4,909,505	27	\$2,081,865	29	\$3,770,307	118	\$10,761,677
Working capital.....		8,472,101		3,678,865		7,079,605		19,230,571
Wages paid.....		3,500,302		1,721,572		3,188,316		8,410,190
Vessels:								
Power vessels over 5 tons.....	232	1,202,346	72	622,716	74	1,051,140	378	2,876,202
Net tonnage.....	4,173		2,103		5,026		11,302	
Launches under 5 tons.....	106	83,428	135	120,705	33	113,698	274	317,831
Sailing.....	4	68,100	9	328,500	31	1,022,800	44	1,419,400
Net tonnage.....	4,331		14,603		45,735		64,679	
Boats, sail and row.....	1,102	68,818	657	50,527	1,348	291,664	3,107	411,009
Lighters, scows, and house-boats.....	338	186,068	204	124,906	180	228,163	722	539,137
Pile drivers.....	50	184,502	42	128,380	26	335,920	118	648,802
Apparatus:								
Haul seines.....	79	28,020	129	43,698	14	7,790	222	79,508
Fathoms.....	12,185		19,481		1,955		33,621	
Purse seines.....	278	157,399	10	8,970	30	60,021	318	226,390
Fathoms.....	49,949		1,725		7,620		59,294	
Gill nets.....	391	45,430	1,055	127,623	2,417	311,263	3,863	484,316
Fathoms.....	58,473		89,066		324,585		472,124	
Pound nets, driven.....	240	854,551	128	374,289	19	62,738	387	1,291,578
Pound nets, floating.....	72	168,485					72	168,485
Dip nets.....			70	175			70	175
Total.....		19,929,055		9,412,791		17,523,425		46,865,271

## PERSONS ENGAGED IN THE SALMON-CANNING INDUSTRY IN 1917.

Occupations and races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
<b>Fishermen:</b>				
Whites.....	1,334	1,139	3,079	5,552
Natives.....	1,348	286	227	1,861
Chinese.....			1	1
Japanese.....	1			1
Mexicans.....	39	3		42
Miscellaneous <sup>a</sup> .....	18	5		23
<b>Total.....</b>	<b>2,740</b>	<b>1,433</b>	<b>3,307</b>	<b>7,480</b>
<b>Shoresmen:</b>				
Whites.....	2,358	788	1,687	4,833
Natives.....	1,832	604	525	2,961
Chinese.....	1,075	497	701	2,273
Japanese.....	740	343	498	1,581
Mexicans.....	308	143	1,042	1,493
Miscellaneous <sup>a</sup> .....	649	312	828	1,789
<b>Total.....</b>	<b>6,962</b>	<b>2,687</b>	<b>5,281</b>	<b>14,930</b>
<b>Transporters:</b>				
Whites.....	418	252	227	897
Natives.....	6	19	1	26
Japanese.....	8	7		15
Miscellaneous <sup>a</sup> .....	1	1		2
<b>Total.....</b>	<b>433</b>	<b>279</b>	<b>228</b>	<b>940</b>
<b>Grand total:</b>				
Whites.....	4,110	2,179	4,993	11,282
Natives.....	3,186	909	753	4,848
Chinese.....	1,075	497	702	2,274
Japanese.....	749	350	498	1,597
Mexicans.....	347	146	1,042	1,535
Miscellaneous <sup>a</sup> .....	668	318	828	1,814
<b>Total.....</b>	<b>10,135</b>	<b>4,399</b>	<b>8,816</b>	<b>23,350</b>

Filipinos, Negroes, Porto Ricans, etc.

OUTPUT OF CANNED SALMON IN 1917.<sup>a</sup>

Product.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
<b>Coho, or silver:</b>	<i>Cases.</i>	<i>Value.</i>	<i>Cases.</i>	<i>Value.</i>	<i>Cases.</i>	<i>Value.</i>	<i>Cases.</i>	<i>Value.</i>
$\frac{1}{2}$ -pound flat....	26,684	\$286,435	3,728	\$41,116			30,412	\$327,551
1-pound flat....	175	1,379	187	1,495			362	2,874
1-pound tall....	125,009	1,040,945	32,007	265,981	5,441	\$45,394	162,457	1,352,320
<b>Total.....</b>	<b>151,868</b>	<b>1,328,759</b>	<b>35,922</b>	<b>308,592</b>	<b>5,441</b>	<b>45,394</b>	<b>193,231</b>	<b>1,682,745</b>
<b>Chum, or keta:</b>								
$\frac{1}{2}$ -pound flat....	26,760	200,764					26,760	200,764
1-pound flat....	1,625	10,209	905	5,430			2,530	15,639
1-pound tall....	736,517	4,462,061	89,721	558,172	51,219	335,411	877,457	5,355,644
<b>Total.....</b>	<b>764,902</b>	<b>4,673,034</b>	<b>90,626</b>	<b>563,602</b>	<b>51,219</b>	<b>335,411</b>	<b>906,747</b>	<b>5,572,047</b>
<b>Hump back, or pink:</b>								
$\frac{1}{2}$ -pound flat....	90,273	761,078	1,130	9,610			91,403	770,688
1-pound flat....	2,193	14,238	3,821	23,694			6,014	37,932
1-pound tall....	2,057,104	13,139,455	140,334	833,225	2,121	12,762	2,199,559	13,985,442
<b>Total.....</b>	<b>2,149,570</b>	<b>13,914,771</b>	<b>145,285</b>	<b>866,529</b>	<b>2,121</b>	<b>12,762</b>	<b>2,296,976</b>	<b>14,794,062</b>
<b>King, or spring:</b>								
$\frac{1}{2}$ -pound flat....	10,423	121,525	321	3,843	2,229	29,870	12,973	155,238
1-pound flat....	1,170	13,259	3,864	37,806	99	890	5,133	51,955
1-pound tall....	12,117	147,896	15,102	139,254	16,626	150,104	43,845	437,254
<b>Total.....</b>	<b>23,710</b>	<b>282,680</b>	<b>19,287</b>	<b>180,903</b>	<b>18,954</b>	<b>180,864</b>	<b>61,951</b>	<b>644,447</b>
<b>Red, or sockeye:</b>								
$\frac{1}{2}$ -pound flat....	56,970	747,180	42,719	541,943	24,620	324,217	124,309	1,613,340
1-pound flat....	23,236	254,573	35,432	383,100	30,944	307,613	89,612	945,286
1-pound tall....	124,589	1,135,038	647,935	6,025,063	1,501,936	13,892,062	2,274,460	21,052,163
<b>Total.....</b>	<b>204,795</b>	<b>2,136,791</b>	<b>726,086</b>	<b>6,950,106</b>	<b>1,557,500</b>	<b>14,523,892</b>	<b>2,488,381</b>	<b>23,610,789</b>
<b>Grand total.....</b>	<b>3,294,845</b>	<b>22,336,035</b>	<b>1,017,206</b>	<b>8,869,732</b>	<b>1,635,235</b>	<b>15,098,323</b>	<b>5,947,286</b>	<b>46,304,090</b>

<sup>a</sup> Cases containing  $\frac{1}{2}$ -pound cans have been reduced one-half in number, and thus, for the purpose of affording fair comparison, all are put upon the basis of forty-eight 1-pound cans per case.



OUTPUT OF CANNED SALMON, 1911 TO 1917.<sup>a</sup>

Product.	1911	1912	1913	1914	1915	1916	1917	Total.
Coho, or silver:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
½-pound flat.....	1,574	2,719	3,587	4,579	2,050	13,145	30,412	58,066
1-pound flat.....	1,075	17	266	285	2,338	8,191	362	13,534
1-pound tall.....	131,259	163,462	71,926	152,199	119,880	240,573	162,457	1,041,756
Total.....	133,908	166,198	75,779	157,063	124,268	261,909	193,231	1,112,356
Chum, or keta:								
½-pound flat.....		2,795	985	373		1,423	26,760	32,336
1-pound flat.....	7,245		2,619	5,568	317		2,530	18,279
1-pound tall.....	316,550	661,838	287,314	657,918	479,629	722,692	877,457	4,003,398
Total.....	323,795	664,633	290,918	663,850	479,946	724,115	906,747	4,054,013
Humpback, or pink:								
½-pound flat.....	4,836	13,712	20,822	2,103	4,325	41,491	91,403	178,692
1-pound flat.....	9,437		3,258	9,286	3,508	14,796	6,014	46,299
1-pound tall.....	991,005	1,266,426	1,348,801	974,660	1,867,683	1,681,506	2,199,559	10,329,640
Total.....	1,005,278	1,280,138	1,372,881	986,049	1,875,516	1,737,793	2,296,976	10,554,631
King, or spring:								
½-pound flat.....	67	5,151	1,585	3,143	2,404	2,617	12,973	27,940
1-pound flat.....				4,804	3,755	3,804	5,133	17,496
1-pound tall.....	45,451	38,166	32,785	40,092	82,092	59,452	43,845	341,883
Total.....	45,518	43,317	34,370	48,039	88,251	65,873	61,951	387,319
Red, or sockeye:								
½-pound flat.....	13,601	28,024	29,041	53,825	52,033	81,565	124,309	382,398
1-pound flat.....	4,967	16,242	11,735	64,671	112,847	86,395	89,612	386,469
1-pound tall.....	1,296,750	1,856,089	1,924,461	2,083,147	1,765,139	1,936,971	2,274,460	13,137,017
½-pound nominals					2,293			2,293
2-pound nominals						6,006		6,006
Total.....	1,315,318	1,900,355	1,965,237	2,201,643	1,932,312	2,110,937	2,488,381	13,914,183
Grand total....	2,823,817	4,054,641	3,739,185	4,056,653	4,500,293	4,900,627	5,947,286	30,022,502

<sup>a</sup> The number of cases shown has been put upon the common basis of forty-eight 1-pound cans per case.

## AVERAGE ANNUAL PRICE PER CASE OF FORTY-EIGHT 1-POUND CANS OF SALMON, 1907 TO 1917.

Product.	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917
Coho, or silver.....	\$3.91	\$3.98	\$4.07	\$4.89	\$5.67	\$4.44	\$3.45	\$4.39	\$4.31	\$5.34	\$8.76
Chum, or keta.....	2.97	2.53	2.28	3.04	3.72	2.37	2.21	3.37	2.59	3.34	6.14
Humpback, or pink.....	3.16	2.69	2.40	3.15	3.94	2.55	2.53	3.50	2.78	3.64	6.44
King, or spring.....	4.18	4.20	4.32	5.34	6.48	5.37	4.04	5.01	4.63	5.36	10.40
Red, or sockeye.....	4.59	4.52	4.53	5.30	6.33	5.45	4.54	5.53	5.82	6.04	9.48

## LOSSES AND DISASTERS IN THE SALMON-CANNING INDUSTRY.

Two canneries were destroyed by fire during the season of 1917. The first of these was that of the Sunny Point Packing Co., at Sunny Point, on September 13. It resulted in the complete destruction of the plant, except floating equipment and 26,115 cases of canned salmon. The value of the property thus lost was \$214,000. The second fire occurred on the night of October 2, when the cannery of the Astoria & Puget Sound Canning Co., at Excursion Inlet, was burned, together with 38,938 cases of salmon. Property valued at \$315,613 was destroyed by this fire. The Anacortes Fisheries Co. sustained a loss of property at its Kasaan plant valued at \$19,530, including buildings, fishing gear, machinery, and supplies. In south-east Alaska other losses of fishing gear and equipment reached a valuation of \$18,629.

The companies operating in central Alaska were fortunate in that only minor losses of equipment and gear, valued at \$3,607, were sustained.

The losses in western Alaska consisted chiefly of vessels. The Alaska Salmon Co. lost the steamer *Thistle*, valued at \$10,000, when it struck a rock in British Columbia while northbound to engage in the season's operations. The Bristol Bay Packing Co. lost the launches *Corinne* and *Grace*, valued at \$9,500. On May 14, the ship *Standard* (1,461 tons net), belonging to Libby, McNeill & Libby, went on a shoal near Cape Constantine and was lost with her cargo, the total value of both being \$97,000. The same company lost the ship *St. Francis* (1,757 tons net), when it went on the rocks in Unimak Pass on May 14. It was valued at \$30,879. On May 9, the bark *St. Katherine*, owned by the Red Salmon Canning Co., was stranded at King Salmon Point, Ugashik River, while loaded with a cargo of cannery supplies for the season's operations. Cargo valued at \$65,000 was lost. New supplies were immediately rushed to the cannery from San Francisco by steamer, and reached there just before the salmon started to run. The *St. Katherine* was refloated by the aid of divers, pumps, and assistance rendered by the steamers *Lehua* and *Kadiak*, and was towed in ballast to San Francisco, where repairs were made. The cost of floating the vessel, towing charges, and repairs, was estimated at \$75,000. Fishing gear and miscellaneous equipment to the value of \$25,691 was also lost in western Alaska.

Considering Alaska as a whole, the value of property lost in the salmon-canning industry in 1917 was \$884,249. The loss of life was greater than usual, 26 men having been drowned or otherwise accidentally killed.

#### MILD CURING OF SALMON.

The production of mild-cured salmon in Alaska in 1917 aggregated 3,563 tierces as against 4,898 in 1916. This decline of about 30 per cent was due not only to the fact that there was a smaller catch of king salmon, but for the reason that a larger number of kings were used for canning than in the preceding season. But little, if any, of this product was exported to European countries, in former years its chief market.

Southeast Alaska continues to produce the bulk of mild-cured salmon, although approximately 100 tierces were packed in central Alaska. No mild-cured salmon were reported in the western district.

A total of 23 operators engaged in the mild-cure industry in southeast Alaska, prominent among whom were the Alaska Herring & Sardine Co., Port Walter; Jakobsen & Hansen, Forrester Island; Noyes Island Packing Co., Noyes Island; Pacific Mild-Cure Co., at Hoonah, Port Conclusion, Taku Harbor, Tyee and Waterfall; Vendsyssel Packing Co., at Tyee; and the Northland Trading & Packing Co., at Saginaw Bay and Port Alexander. In central Alaska, the Kachemak Canning Co., at Tyonic, put up practically the entire mild-cured product of the district. This was incidental to the herring operations of the company.

## INVESTMENT IN THE SALMON MILD-CURING INDUSTRY OF SOUTHEAST ALASKA IN 1917.

Items.	No.	Value.	Items.	No.	Value.
Fixed plants.....	10	\$116,671	Gear:		
Operating capital.....		325,313	Seines, purse.....	1	\$225
Vessels:			Fathoms.....	25	
Power vessels over 5 tons.....	23	85,128	Seines, beach.....	4	1,250
Net tonnage.....	354		Fathoms.....	440	
Launches under 5 tons.....	1,364	329,700	Gill nets.....	28	10,950
Boats, sail and row.....	930	27,800	Fathoms.....	5,340	
Lighters and scows.....	7	5,310	Pound nets, driven.....	2	15,000
Pile drivers.....	1	6,000	Troll lines.....	2,505	17,590
			Total.....		940,937

## PERSONS ENGAGED IN THE SALMON MILD-CURING INDUSTRY OF SOUTHEAST ALASKA IN 1917.

Occupations and races.	No.	Occupations and races.	No.
Fishermen:		Transporters:	
Whites.....	1,933	Whites.....	64
Natives.....	1,000	Natives.....	2
Total.....	2,933	Total.....	66
Shoresmen:		Grand total.....	3,137
Whites.....	106		
Natives.....	32		
Total.....	138		

## PRODUCTS OF THE SALMON MILD-CURING INDUSTRY IN 1917.

Species.	Tierces.	Pounds.	Value.
Southeast Alaska:			
King salmon.....	2,937	2,349,600	\$301,580
Coho salmon.....	327	261,600	21,590
Chum salmon.....	91	72,800	4,015
Humpback salmon.....	97	77,600	3,840
Red salmon.....	5	4,000	200
Total.....	3,457	2,765,600	331,205
Central Alaska: King salmon.....	106	84,800	12,823
Grand total.....	3,563	2,850,400	344,028

## SALMON PICKLING.

Salmon pickling in Alaska in 1917 was carried on to a considerably greater extent than in 1916. The industry shows material gains in the number of salteries and in the investment. The production of pickled salmon was also approximately 100 per cent greater than in 1916.

A total of 37 salteries were operated, of which the southeastern district had 13, the central district 11, while the western district is credited with 13. This is a gain of 11 for southeast Alaska and 6 for western Alaska. The number in the central district is unchanged. The increase for the entire territory was 17. Investments in 1917 were \$862,399, as against \$340,887 in 1916, a gain of \$522,512. The number of persons employed increased from 277 in 1916 to 509 in 1917.

Western Alaska continues to lead in the production of pickled salmon, the bulk of the yield of reds coming from that district.

Among the large operators may be mentioned the Alaska Packers Association, Alaska Salmon Co., Libby, McNeill & Libby, Peter M. Nelson, and Olson Bros., all of whom are established in the Bristol Bay district.

In 1917 Alaska produced 36,390 barrels of pickled salmon, as against 17,734 barrels in 1916. The value of the pack was \$590,497, an increase over 1916 of \$377,830. According to these figures, the average value per barrel was \$16.20.

#### INVESTMENT IN THE SALMON PICKLING INDUSTRY IN 1917.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Salteries .....	13	\$62,320	11	\$69,514	13	\$129,018	37	\$260,852
Operating capital .....		85,462		71,154		247,664		404,280
Vessels:								
Power vessels over 5 tons .....	8	36,062	6	21,550	1	5,500	15	63,112
Net tonnage .....	111		92		10		213	
Launches under 5 tons .....	6	4,850	6	7,900	4	6,400	16	19,150
Sailing .....					4	47,000	4	47,000
Net tonnage .....					1,070		1,070	
Boats, sail and row .....	22	945	39	1,790	72	10,530	131	13,265
Lighters and scows .....	4	2,470	4	800	8	6,100	16	9,370
Gear:								
Haul seines .....	10	2,025	26	4,572	7	910	43	7,507
Fathoms .....	920		2,660		345		3,815	
Purse seines .....	3	2,990	1	1,500			4	4,490
Fathoms .....	365		250				615	
Gill nets .....	5	715	94	8,503	119	11,896	217	21,114
Fathoms .....	455		6,570		8,355		15,380	
Lines .....	3	5	15	405	2	2	20	412
Pound nets, driven .....			6	13,000			6	13,000
Pound nets, floating .....	1	1,890					1	1,890
Total .....		199,734		200,688		465,020		865,442

#### PERSONS ENGAGED IN THE SALMON PICKLING INDUSTRY IN 1917.

Occupations and races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites .....	44	33	86	163
Natives .....		15	63	78
Mexicans .....			12	12
Total .....	44	48	161	253
Shoresmen:				
Whites .....	59	21	74	154
Natives .....		10	42	52
Total .....	59	31	116	206
Transporters:				
Whites .....	29	9	11	49
Natives .....		1		1
Total .....	29	10	11	50
Grand total .....	132	89	288	509

BARRELS <sup>a</sup> OF SALMON PICKLED IN 1917, BY SPECIES.

Product.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Coho, or silver .....	1,387	\$22,275	185	\$3,230	226	\$4,126	1,798	\$29,631
Coho bellies .....	11	326					11	326
Chum, or keta .....	959	11,948	512	7,271	251	2,680	1,722	21,899
Chum bellies .....	15	300	42	630	16	432	73	1,362
Humpback, or pink .....	5,453	72,724	80	617	43	516	5,576	73,857
Humpback bellies .....	84	2,245	24	600	2	40	110	2,885
King, or spring .....	1	15	62	1,157	296	5,384	359	6,556
King bellies .....			7	150			7	150
Red, or sockeye .....	50	921	2,368	45,489	24,292	406,609	26,710	453,019
Red bellies .....			22	770	2	42	24	812
Total .....	7,960	110,754	3,302	59,914	25,128	419,829	36,390	590,497

<sup>a</sup> Barrels holding 200 pounds of fish.

## SALMON FREEZING.

All plants equipped for the freezing of salmon are located at the more important fishing centers in southeast Alaska, except one which was built at Seward, in central Alaska, by the San Juan Fishing & Packing Co. Those in southeast Alaska are owned and located as follows: New England Fish Co. and Ketchikan Cold Storage Co., at Ketchikan; Booth Fisheries Co., at Sitka; Columbia & Northern Fishing & Packing Co., at Wrangell; Juneau Cold Storage Co., at Juneau; Taku Canning & Cold Storage Co., at Taku Harbor; and the Glacier Fish Co., at Petersburg and at Scow Bay, where the barge *Glory of the Seas* was used as a cold-storage plant.

The output of frozen salmon in 1917 was 1,282,182 pounds, valued at \$81,574. This is an increase in production of 418,776 pounds and in value of \$47,166 over the figures reported in 1916.

One trap, valued at \$2,500, and owned by the Juneau Cold Storage Co., is credited to this branch of the industry.

## SALMON FROZEN IN ALASKA IN 1917.

Species.	Pounds.	Value.
Coho salmon .....	415,174	\$24,308
Chum salmon .....	302,816	14,769
Humpback salmon .....	226,253	9,086
King salmon .....	301,777	30,460
Red salmon .....	36,162	2,951
Total .....	1,282,182	81,574

## FRESH-SALMON TRADE.

Customs records at Juneau show that 3,559,785 pounds of fresh salmon were shipped from Alaska in 1917 and that the value of this product was \$304,048. This is an increase over the figures given for 1916, when the production was 1,480,515 pounds of salmon, valued at \$118,316. The trade in fresh salmon fluctuates considerably as the demand for salmon in the other industries may be great or small. With the high prices paid for salmon at the canneries and freezing plants, few operators found markets sufficiently attractive

to justify the additional cost of preparing their fish fresh for shipment. Those who made large shipments of fresh salmon from Alaska were H. Bergman, at Ketchikan; National Independent Fisheries Co., at Juneau; Pacific Mild-Cure Co., at Waterfall; C. M. Coulter, at Wrangell; Alaska Coast Fish Co., at Douglas; Glacier Fish Co., at Petersburg; and Lars Hansen, at Kake.

Several of these companies are engaged in the fresh-salmon trade only incidentally, as their major operations are along other lines. This business shows, however, some investment in plants, boats, and fishing apparatus; it also shows a considerable outlay in wages paid to those employed in it.

#### INVESTMENT IN THE FRESH-SALMON TRADE OF SOUTHEAST ALASKA IN 1917.

Items.	Num-ber.	Value.	Items.	Num-ber.	Value.
Plants.....		\$8,670	Seines, beach (500 fathoms).....	5	\$1,441
Operating capital.....		31,500	Seines, purse (100 fathoms).....	1	880
Wages paid.....		11,662	Gill nets (575 fathoms).....	4	480
Launches.....	5	15,200	Pound nets, driven.....	3	11,500
Rowboats.....	6	119			
Scows.....	1	90	Total.....		81,542

A total of 37 persons were employed by the concerns, engaged principally in the marketing of fresh salmon. Statistics are not available to show the quantity of salmon that was used fresh locally, but it may be estimated as having been 1,000,000 pounds, having a value of \$100,000. In view of the fact that fresh salmon are served throughout the season in all leading restaurants and hotels in Alaska and on all steamers plying along its coast, the above estimate may be too conservative. A large quantity of fresh salmon was also consumed at the various canneries and fisheries, which it would be desirable to include in order that the fisheries might receive full credit for what they produced.

#### DRY SALTING, DRYING, AND SMOKING OF SALMON.

In southeastern Alaska the Cross Sound Packing Co. of Alaska, at Gull Cove, dry salted 1,500 pounds of red salmon, valued at \$120, and 53,100 pounds of humpback salmon, valued at \$2,424. In central Alaska the Kenai Fishing & Packing Co., at Eshamy Bay, dry salted 100,000 pounds of red salmon, valued at \$10,500. At Apokak, in western Alaska, the Kuskokwim Fishing & Transportation Co. dry salted 47,000 pounds of king salmon, valued at \$4,700; 130,000 pounds of red salmon, valued at \$11,700; and 40,000 pounds of coho salmon, valued at \$3,600.

The only reported drying and smoking of salmon was done by the Beluga Whaling Co., at Three Mile Creek, Cook Inlet. About 1,400 pounds of beleke, valued at \$350, and 4,000 pounds of red salmon, valued at \$450, were prepared in this way and marketed in Alaska.

The Yukon River and its tributaries furnish large numbers of salmon which are dried and smoked for local use by the Indians and others, and as food for dogs. Accurate statistics of the number thus used are not at present available, but it is known that hundreds of tons of dried or smoked salmon are thus used. This source of food

is of vital importance and its continuance must be insured. Doubtless all of the large rivers that flow from the interior of Alaska contribute some salmon for the sustenance of the people who live along their banks, and were it possible to gather data showing the quantity so consumed the production of the fisheries would be considerably augmented.

Reports have been received for a total in 1917 of 377,000 pounds of salmon dry salted, dried, and smoked in Alaska, valued at \$53,844.

#### SALMON BY-PRODUCTS.

The manufacture of oil and fertilizer from offal and waste material at the salmon canneries was engaged in by the Fish Cannery By-Products Co. at Ward Cove, and the Pacific American Fisheries at Excursion Inlet. The North Pacific Trading & Packing Co. did not utilize any of the refuse from its cannery at Klawak in the preparation of by-products as formerly, and its plant was therefore not in operation.

The investment in this industry in 1917 was \$108,153, as compared with \$124,709 in 1916. Sixty-five men were employed in this work in 1917, which is 10 less than the number employed in 1916. The value of the products was \$61,873, an increase of \$13,948 over the output in 1916.

#### OUTPUT IN BY-PRODUCTS INDUSTRY IN ALASKA IN 1917.

Items.	Quantity.	Value.
Oil.....gallons..	25,150	\$19,560
Fertilizer.....tons..	821	42,313
Total.....		61,873

#### HALIBUT FISHERY.

The halibut fishery of Alaska comes next to the salmon fishery in quantity and value of product. The halibut fishery off the coast of Alaska is conducted chiefly upon seven fishing grounds, which, in the order of their location from east to west, are generally designated as follows: Noyes Island, Coronation Island, Cape Spencer, Yakutat, Yakataga, Cape Cleare, and Portlock Bank. All of these localities are visited by the larger vessels of the halibut fleet, the Yakutat grounds and Portlock Bank producing probably the bulk of the catch delivered at Puget Sound and British Columbia ports. The smaller vessels as a rule frequent the inshore grounds of southeast Alaska, and deliver their catches principally at Alaskan ports, although the larger of these boats often go to Prince Rupert.

As for several years past, vexing problems in connection with conflicting American and Canadian interests in the Pacific coast halibut fishery have continued to occur. Some American interests have felt that the trend of the halibut trade toward Prince Rupert has been caused by unwarranted activities that demanded and justified prompt and decisive action lest Canada profit greatly at the expense of this country. Upon the other hand, Canadian interests have no doubt felt that they were within their rights in taking advantage of trans-

continental railroad terminal facilities at Prince Rupert, nearer some of the important fishing grounds than other important railroad centers, to build up as large a trade as possible in the halibut industry.

#### STATISTICAL SUMMARY.

The investment in the halibut industry in Alaska was \$2,200,987 in 1917 as compared with \$2,149,311 in 1916, an increase of \$51,676. The number of persons employed in this fishery declined from 1,116 in 1916 to 909 in 1917, the difference having been absorbed by the salmon industry and credited to it. The halibut fisheries produced a total of 13,153,411 pounds, valued at \$1,120,226. This is an increase of 1,657,854 pounds over the production in 1916. In a comparison of the selling price of halibut by independent fishing vessels at the ports of Seattle, Prince Rupert, and Ketchikan, it appears that the average price per pound received by the fishermen throughout the year was  $9\frac{1}{2}$  cents at Ketchikan,  $12\frac{1}{2}$  cents at Prince Rupert, and  $15\frac{1}{2}$  cents at Seattle. The average price at Petersburg was probably not higher than  $7\frac{1}{2}$  or 8 cents per pound. The Ketchikan figures are based on prices paid in January, February, March, June, August, and September. Quotations for the other months are not reported, but it is improbable that the general average would be materially changed by their inclusion. Prices for the months named ranged from  $12\frac{1}{4}$  cents in February to 7 cents in March.

Prices for Prince Rupert are for the entire year and are  $33\frac{1}{2}$  per cent higher than in Alaska. The highest price was  $18\frac{3}{4}$  cents per pound in October, and the lowest 7 cents in March.

Seattle prices averaged  $66\frac{2}{3}$  per cent higher than those at Ketchikan. In 1917 halibut sold at 8 cents per pound in May and 30 cents in September.

The total catch of halibut on the Pacific coast was approximately 60,000,000 pounds, of which probably 30,000,000 pounds were taken from the grounds contiguous to the coast of Alaska. Available statistics show, however, that only a little more than 13,000,000 pounds was credited to Alaska. Undoubtedly a large part of the halibut delivered at Prince Rupert is also taken on these grounds, so that the estimate as above given is substantially correct.

Those chiefly engaged in the halibut industry in Alaska in 1917 were the Alaska Coast Fish Co., at Douglas; Booth Fisheries Co., at Sitka; Columbia & Northern Fishing & Packing Co., at Wrangell; Glacier Fish Co., at Petersburg and at Scow Bay, where the barge *Glory of the Seas* was used as a floating cold-storage plant; Juneau Cold Storage Co. and National Independent Fisheries Co., at Juneau; Taku Canning & Cold Storage Co., at Taku Harbor; New England Fish Co. and Washington Fish & Oyster Co., at Ketchikan; and the San Juan Fishing & Packing Co., at Seward. Buyers for the Ripley Fish Co. were located at Petersburg and Ketchikan.

The New England Fish Co. suffered the loss of the steamer *Manhattan* off Cape Spencer during a severe storm on November 15, 1917. This vessel (134 tons net) was valued at \$125,000.



## INVESTMENT IN THE ALASKA HALIBUT FISHERIES IN 1917.

Items.	Number.	Value.	Items.	Number.	Value.
Fishing vessels:			Dories and scows.....	299	\$18,800
Steamer and gas.....	136	\$954,090	Fishing apparatus.....		57,105
Tonnage.....	2,536		Shore and fixed property.....		265,100
Sailing.....	1	153,000			
Tonnage.....	2,247		Total.....		2,200,987
Launches.....	3	2,892			
Outfit.....		750,000			

## PERSONS ENGAGED IN THE ALASKA HALIBUT FISHERIES IN 1917.

Races.	Number.
Whites.....	899
Natives.....	10
Total.....	909

## PRODUCTS OF THE ALASKA HALIBUT FISHERY IN 1917.

Products.	Pounds.	Value.
Halibut:		
Fresh (including local).....	7,038,283	\$605,205
Frozen.....	6,115,128	515,021
Total.....	13,153,411	1,120,226

The following additional statistics of the Pacific halibut industry were submitted by E. J. Brown, local agent of the Bureau at Seattle, who, in January, 1918, visited the important halibut fishing centers of Alaska and British Columbia:

## HALIBUT LANDINGS AT PRINCIPAL PORTS OF THE NORTH PACIFIC, 1912 TO 1917.

Ports.	1912	1913	1914	1915	1916	1917	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Seattle.....	27,246,100	29,916,500	35,520,400	27,906,473	16,152,135	15,872,000	152,613,908
Ketchikan.....	6,806,003	8,744,850	6,305,175	5,226,840	4,107,311	4,008,000	35,198,179
Prince Rupert.....		7,320,755	8,742,100	18,722,877	19,278,395	18,140,000	72,204,127
Vancouver, British Columbia..	16,550,000	8,833,500	6,868,500	8,986,000	6,853,000	5,162,000	53,253,000
Total.....	50,602,103	54,815,605	57,436,175	60,842,190	46,390,841	43,182,000	313,268,914

POUNDS OF HALIBUT LANDED BY OFFSHORE FISHING FLEET AT PRINCE RUPERT, BRITISH COLUMBIA, DURING YEAR 1917, SHOWING RECEIPTS BY VARIOUS FIRMS FROM INDEPENDENT AND COMPANY-OWNED VESSELS.

Months.	Canadian Fish & Cold Storage Co.		National Independent Fisheries (independent).	Royal Fish Co. (independent).	Pacific Fisheries Co. (independent).	Atlin Fisheries (Ltd.).	
	Independent.	Company.				Independent.	Company.
January.....	243,000	102,000	.....	.....	88,000	63,000	.....
February.....	328,000	57,000	.....	.....	34,000	70,000	.....
March.....	501,000	176,000	.....	.....	201,000	218,000	105,000
April.....	803,000	241,000	30,000	.....	181,000	485,000	.....
May.....	1,178,000	531,000	.....	69,000	86,500	535,500	20,000
June.....	860,000	468,000	29,000	128,000	.....	402,000	.....
July.....	1,042,000	370,000	.....	134,000	109,000	327,000	.....
August.....	744,000	280,000	31,000	60,000	50,000	298,000	.....
September.....	768,000	312,000	.....	81,000	.....	252,000	16,000
October.....	469,000	179,000	.....	78,000	.....	35,000	111,000
November.....	595,000	238,000	.....	40,000	.....	73,000	.....
December.....	187,000	272,000	.....	2,000	.....	.....	.....
Total.....	7,718,000	3,226,000	90,000	592,000	749,500	2,753,500	252,000

Months.	Booth Fisheries Co.		Total.		Grand total.
	Independent.	Company.	Independent.	Company.	
January.....	44,000	42,000	438,000	144,000	582,000
February.....	8,000	35,000	440,000	92,000	532,000
March.....	206,000	30,000	1,126,000	311,000	1,437,000
April.....	271,000	.....	1,770,000	241,000	2,011,000
May.....	380,000	.....	2,249,000	551,000	2,800,000
June.....	357,000	55,000	1,776,000	523,000	2,299,000
July.....	422,000	.....	2,034,000	370,000	2,404,000
August.....	286,000	.....	1,469,000	280,000	1,749,000
September.....	253,000	.....	1,354,000	328,000	1,682,000
October.....	153,000	.....	735,000	290,000	1,025,000
November.....	102,000	.....	810,000	238,000	1,048,000
December.....	110,000	.....	299,000	272,000	571,000
Total.....	2,592,000	162,000	14,500,000	3,640,000	18,140,000

PURCHASES OF HERRING BAIT AT KETCHIKAN BY CANADIAN HALIBUT VESSELS IN 1917.

Date.	Name of vessel.	Pounds.	Date.	Name of vessel.	Pounds.
Jan. 3	Chief Seugaid <i>a</i> .....	10,000	Oct. 23	Grier Sterrett <i>a</i> .....	7,130
13	W. R. Lord <i>a</i> .....	4,000	25	Chief Zibassa <i>a</i> .....	8,020
30	Chief Zibassa <i>a</i> .....	12,305	Nov. 8	G. E. Foster <i>a</i> .....	10,340
Feb. 23	Chief Seugaid <i>a</i> .....	10,000	11	Andrew Kelly <i>a</i> .....	10,000
Mar. 7	Grier Sterrett <i>a</i> .....	6,000	14	James Carruthers <i>a</i> .....	10,000
July 15	Charlotte G. Cox.....	13,840	21	Chief Zibassa <i>a</i> .....	12,000
Oct. 6	Grier Sterrett <i>a</i> .....	7,200	16	Sitka <i>a</i> .....	10,000
8	King Salmon.....	1,500	30	D. C. F., No. 1.....	16,000
10	Chief Seugaid <i>a</i> .....	5,300	30	Summer <i>a</i> .....	7,080
17	Margaliu.....	1,500	Dec. 1	G. E. Foster <i>a</i> .....	10,080
17	Andrew Kelly <i>a</i> .....	10,100	2	Andrew Kelly <i>a</i> .....	10,000
17	G. E. Foster <i>a</i> .....	10,035	5	James Carruthers <i>a</i> .....	10,080
21	Caygeon.....	1,500	15	Kings Way.....	10,000
22	Charlotte G. Cox.....	8,050	19	Sitka <i>a</i> .....	4,020
24	James Carruthers <i>a</i> .....	25,025			
23	Muliereag.....	2,310		Total.....	263,435

*a* Owned and operated by the Canadian Fish & Cold Storage Co.

## COD FISHERY.

The quantity of cod produced in Alaska in 1917 was hardly equal to that of the preceding year, but in value it greatly exceeded the output of 1916. At times during the year the demand for Alaska cod was greater than the supply, and there was some fear that the catch would be extremely light, with a correspondingly serious effect upon the trade.

Ordinarily the demand for cod in the West Indies must be reckoned with in any distribution of the supply, but, fortunately perhaps, there was no call from that quarter until much later than usual, as some importations had been made from Nova Scotia and Labrador. The resulting surplus thus opened the way for the development of markets in South America. The Hawaiian Islands and Australia received a part of the cod products of Alaska.

## VESSEL FISHERY.

The Northern Fisheries (Inc.), of Anacortes, is the only new concern to engage in the vessel cod fishery of Alaska in 1917. It operated the auxiliary schooner *Progress* (115 tons) in fishing off the Alaskan coast from the Shumagin Islands to the westward, and also as a transporting vessel for the station at Kodiak. The schooner *Fortuna* (138 tons), operated by the Pacific Coast Codfish Co. in 1916, did not go to Alaska in 1917. The Alaska Codfish Co. added one vessel, the schooner *S. N. Castle* (464 tons net), to its fleet.

## ALASKA COD FLEET, 1917.

Names.	Rig.	Net tonnage.	Operators.
Azalea.....	Schooner.....	327	J. A. Matheson, Anacortes, Wash.
Fanny Dutard.....	do.....	252	Do.
Wawona.....	do.....	413	Robinson Fisheries Co., Anacortes, Wash.
Alice.....	do.....	220	Do.
John A.....	do.....	235	Pacific Coast Codfish Co., Seattle, Wash.
Charles R. Wilson.....	do.....	328	Do.
Maid of Orleans.....	do.....	171	Do.
Glendale.....	do.....	281	Alaska Codfish Co., San Francisco, Cal.
Allen A <sup>a</sup> .....	do.....	266	Do.
City of Papeete <sup>a</sup> .....	do.....	370	Do.
Maweema.....	do.....	392	Do.
S. N. Castle.....	do.....	464	Do.
Sequoia.....	do.....	324	Union Fish Co., San Francisco, Cal.
Vega.....	do.....	223	Do.
Galilee.....	do.....	328	Do.
Martha.....	do.....	14	Do.
Golden State <sup>b</sup> .....	Power schooner.....	233	Do.
Pirate.....	do.....	30	Do.
Union Flag.....	do.....	7	Do.
Progress <sup>c</sup> .....	do.....	115	Northern Fisheries (Inc.), Anacortes, Wash.
Hunter <sup>d</sup> .....	do.....	60	Do.
Valdez.....	do.....	10	Do.
Harold Blekum <sup>e</sup> .....	Schooner.....	192	Do.
Chas. Brown.....	do.....	64	Do.

<sup>a</sup> Transporting vessel for shore stations; also made one fishing voyage.

<sup>b</sup> Transporting vessel.

<sup>c</sup> Transporting vessel; also made two fishing voyages.

<sup>d</sup> Wrecked Aug. 30, 1917.

<sup>e</sup> Wrecked Mar. 3, 1917.

## SHORE STATIONS.

Three companies, engaging in fishery business in southeast Alaska, are to be noted among the operators of cod shore stations incidental to their salmon and halibut operations. They are the New England Fish Co., at Ketchikan; Taku Canning & Cold Storage Co., at Taku Harbor; and Advance Fisheries Co., at Craig. The central district shows several additional operators. The following in this district handled cod, either as incidental to other lines or as their chief business: Columbia River Packers' Association, at Chignik; Kadiak Fisheries Co., and Northern Fisheries (Inc.), at Kodiak; Gus Ohm, at Cordova; San Juan Fishing & Packing Co., at Seward; W. J. Riegel, at Uyak Bay; Shumagin Packing Co. and John H. Nelson at Squaw Harbor; Pacific American Fisheries, at King Cove; Deep Sea Codfish Co., at Unga; N. H. Johnson, at Snug Harbor; North Pacific Sea Products Co., at Akutan; Alaska Codfish Co., at Kelleys Rock and Unga on Unga Island, Companys Harbor and Murphys Cove on Sannak Island, and Dora Harbor on Unimak Island; Union Fish Co., at Pirate Cove on Popof Island, Unga on Unga Island, Sanborn Harbor and Eagle Harbor on Nagai Island, Northwest Harbor on Herendeen Island, Pavlof Harbor and Johnson Harbor on Sannak Island, and Tigalda Lagoon on Tigalda Island; Akutan Codfish Co., at Akutan; Pacific American Fisheries at Makushin and Port Moller; and the Nelson Lagoon Packing Co., at Nelson Lagoon.

The Pacific American Fisheries and the Nelson Lagoon Packing Co. experimented further in the canning of cod by packing 2,070 cases of 1-pound flat cans and 567 cases of one-half-pound flat cans.

The Northern Fisheries (Inc.), lost two vessels during the year, the first being the schooner *Harold Blekum* (192 tons net), which was wrecked in Ugak Bay, Kodiak Island, on March 3, 1917. This vessel was valued at \$15,000. The second loss occurred on August 30, when the auxiliary schooner *Hunter* (60 tons net), struck a rock off Sutwik Island and foundered immediately. This vessel was valued at \$10,000, and was returning to Kodiak from a fishing voyage to western waters. Three fishermen were drowned and one was accidentally killed while engaged in this industry.

## STATISTICAL SUMMARY.

The Alaska codfish industry shows an investment of \$1,408,265, which is an increase of \$844,053 over 1916. A total of 795 persons were employed, as compared with 778 in 1916.

This fishery produced a total of 13,777,470 pounds of cod, valued at \$744,976. This is a decrease of 524,894 pounds in production, and an increase of \$226,179 in value.

## INVESTMENT IN THE COD FISHERY IN ALASKA IN 1917.

Items.	Num-ber.	Value.	Items.	Num-ber.	Value.
Value of shore stations.....		\$126,843	Vessels—Continued:		
Operating capital.....		949,014	Boats, row.....	472	\$18,265
Vessels:			Pile drivers.....	2	250
Power vessels over 5 tons...	5	67,817	Apparatus: Hand lines.....	3,510	1,776
Net tonnage.....	358				
Launches under 5 tons.....	13	13,000	Total.....		1,408,265
Sailing vessels.....	17	231,300			
Net tonnage.....	4,682				

## PERSONS ENGAGED IN THE ALASKA COD FISHERY IN 1917.

Occupations and races.	Number.	Occupations and races.	Number.
Fishermen:		Transporters: Whites.....	20
Whites.....	695	Grand total.....	795
Natives.....	36		
Total.....	731		
Shoresmen:			
Whites.....	40		
Natives.....	4		
Total.....	44		

## PRODUCTS OF ALASKA COD FISHERY IN 1917.

Products.	Pounds.	Value.	Products.	Pounds.	Value.
Vessel catch:			Canned:		
Dry-salted cod.....	9,825,044	\$541,230	In $\frac{1}{2}$ -pound flats (567 cases).....	13,008	\$2,338
Pickled cod.....	417,256	17,240	In 1-pound flats (2,070 cases).....	99,360	12,420
Tongues.....	16,800	1,440	Total.....	112,968	14,758
Total.....	10,259,100	559,910			
Shore-station catch:			Total:		
Dry-salted cod.....	2,137,534	94,167	Dry-salted cod.....	11,962,578	635,397
Pickled cod.....	968,438	57,666	Pickled cod.....	1,385,694	74,906
Stockfish.....	69,200	12,400	Stockfish.....	69,200	12,400
Tongues.....	6,400	480	Tongues.....	23,200	1,920
Frozen.....	223,830	5,595	Frozen cod.....	223,830	5,595
Total.....	3,405,402	170,308	Canned.....	112,968	14,758
			Total.....	13,777,470	744,976

## HERRING FISHERY.

By reason of the lessened importation of pickled herring from abroad, consequent upon the extraordinary demand for such products in other countries, American consumers could not be supplied to the full extent of their demands. In order to stimulate production, and to enable the packers to prepare a commodity acceptable to the general trade and thus in a measure offset the shortage of imported herring, the Government secured the services of Aug. H. D. Klie, a recognized expert in the preparation of herring by the Scotch cure. Early in May, 1917, he was sent to Alaska, which was regarded as the most promising field for exploitation and development, and was authorized to make such demonstration of the Scotch method and give such instruction to designated assistants as would enable them to aid and encourage herring packers in southeast and central Alaska, where operations were chiefly carried on.

Directions in printed form were mailed early in the season to all companies and individuals who were known to be interested in any phase of the Alaskan fisheries, and their cooperation was requested in making a determined effort to utilize a much neglected food fish, thus increasing food supplies and lightening the drain on other meat supplies so urgently needed abroad in the commissariat of the army of this and allied countries.

As special assistants to Mr. Klie, William P. Studdert, Clarence L. Anderson, and Donald R. Crawford were sent to Alaska, and

after acquiring a thorough practical working knowledge of the Scotch method of curing herring, a process previously unknown in Alaska, they proceeded to separate districts to render aid and give practical demonstrations and instructions to interested persons. Mr. Crawford was assigned to the southeastern district, Mr. Anderson to the Prince William Sound region, with headquarters at Cordova, and Mr. Studdert devoted most of his attention to the important Cook Inlet section, centering at Seldovia.

The efforts of the Government along this line were met in a commendable manner by two of the large companies interested in the fisheries of Alaska—the Alaska Herring & Sardine Co. and the Alaska Pacific Herring Co., both at Port Walter. These two companies packed several hundred barrels of Scotch-cured herring. Smaller operators manifested a willingness to follow the Scotch cure, and encouraging results were obtained. The greater part of the herring pickled in Alaska in 1917 was prepared, however, according to the Norwegian formula. This may be due to the fact that it requires less work to pack herring in this way. Moreover, no particular style of barrel is required, whereas the packing of herring by the Scotch cure involves more labor and care and requires a special barrel, but a better article and one that the trade demands is obtained. It was to meet the needs of the market and stimulate the production of a highly desirable aquatic food that the Government inaugurated the campaign to establish the Scotch-cure method of preparing herring in Alaska. As a direct result of this work, 1,877,450 pounds, or 7,622 barrels, of herring were Scotch cured in Alaska in 1917, as compared with nothing previously. At the same time 13,576 barrels were packed by the Norwegian method.

#### STATISTICAL SUMMARY.

In 1917 the investment in the herring fishery of Alaska was \$562,002, as compared with \$509,046 in 1916. This is a very creditable showing when viewed in connection with the fact that the investments of the Alaska Herring & Sardine Co. and the Alaska Pacific Herring Co. are now included in the investments in the salmon industry, since both companies made considerable packs of canned salmon. The number of persons engaged was 214, as compared with 392 in 1916. The products were valued at \$767,729, as compared with \$418,076 in 1916, the gain being \$349,653.

#### INVESTMENT IN THE HERRING FISHERY OF ALASKA IN 1917.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Plants operated.....	7	\$100,700	5	\$107,340	2	\$5,800	14	\$213,840
Operating capital.....		177,087		80,083		9,100		266,270
Vessels:								
Power vessels over 5 tons.	6	19,300	2	13,000	1	850	9	33,150
Net tonnage.....	176		38				214	
Launches under 5 tons...	3	3,800	4	5,100	1	800	8	9,700
Boats, row and seine.....	18	2,350	32	2,830	4	375	54	5,555
Lighters and scows.....	6	4,750	9	7,912	1	250	16	12,912
Pile drivers.....	2	1,500	1	1,200			3	2,700
Gear:								
Seines.....	14	10,600	7	2,300	1	350	22	13,250
Fathoms.....	1,830		550		65		2,445	
Gill nets.....			96	3,905	32	720	128	4,625
Fathoms.....			4,990		430		5,420	
Total.....		320,087		223,670		18,245		562,002

## PERSONS ENGAGED IN THE ALASKA HERRING FISHERY IN 1917.

Occupations and races.	Number.	Occupations and races.	Number.
<b>Fishermen:</b>		<b>Shoresmen: Whites.....</b>	<b>27</b>
Whites.....	98	<b>Transporters: Whites.....</b>	<b>9</b>
Natives.....	79	<b>Grand total.....</b>	<b>214</b>
Chinese.....	1		
<b>Total.....</b>	<b>178</b>		

## PRODUCTS OF ALASKA HERRING FISHERY IN 1917.

Products.	Quantity.	Value.
<b>Herring:</b>		
Dry salted, for food.....pounds..	165,000	\$11,349
Fresh, for food.....do.....	6,000	480
Fresh, for bait.....do.....	2,093,600	25,735
Frozen, for food.....do.....	17,082	427
Frozen, for bait.....do.....	3,996,180	31,821
Pickled, for food.....barrels.....	<sup>a</sup> 21,198	248,299
Canned.....cases.....	<sup>b</sup> 49,245	326,522
Smoked, for food.....pounds.....	21,600	700
Oil.....gallons.....	205,992	82,396
Fertilizer.....tons.....	1,037	40,000
<b>Total.....</b>		<b>767,729</b>

<sup>a</sup> Includes 6,521 barrels, of 250 pounds, and 1,091 half barrels, of 125 pounds, of Scotch-cured herring.

<sup>b</sup> Includes 8,557 cases, of one-half-pound oval cans at 96 cans per case, and 7,370 cases, of one-half-pound ovals at 48 cans per case.

## WHALE FISHERY.

## SHORE STATIONS.

The United States Whaling Co., at Port Armstrong, and the North Pacific Sea Products Co., at Akutan, continued as the principal operators in the whaling industry. The Beluga Whaling Co., at Beluga River, was the only other concern to engage in whaling, but its activities were confined to the capture of belugas, or white whales, in Cook Inlet. In the past similar operations were carried on near Nome by Nygren & Torkensen, but there is no record that they operated in 1917.

The United States Whaling Co. operated the steamers *Star I* (133 tons), *Star II* and *Star III* (97 tons each), in whale killing as formerly. The North Pacific Sea Products Co., in addition to the steamers *Kodiak* and *Unimak* (99 tons each), and the *Tanginak* (71 tons), also operated the power schooner *Halcyon* (61 tons), as a whaling vessel, while the barge *Fresno* (1,149 tons) was again used as a transporting vessel.

## STATISTICAL SUMMARY.

The investment in the whaling industry in Alaska in 1917 was \$1,609,926, an increase of \$518,455 over 1916. A total of 162 persons was employed as against 233 in 1916. The value of the product was \$654,852, which is a gain of \$291,131 over 1916. Shore-station operations resulted in the capture of 423 whales, which is 34 more than the take of the previous year.

## WHALES TAKEN IN SHORE OPERATIONS IN 1917.

Species.	Number.	Species.	Number.
Bowhead.....	2	Beluga.....	9
Finback.....	153	Others.....	26
Humpback.....	44		
Sulphur-bottom.....	138	Total.....	423
Sperm.....	51		

## INVESTMENT IN SHORE WHALE FISHERY IN ALASKA IN 1917.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels:			Pile drivers.....	1	\$100
Steamers.....	8	\$292,500	Seines.....	14	6,000
Net tonnage.....	662		Guns.....	5	5,625
Barge.....	1	30,000	Value of plants.....		492,000
Net tonnage.....	1,149		Cash capital.....		644,300
Launches under 5 tons.....	4	4,900	Wages paid.....		132,141
Boats, row.....	4	260			
Scows.....	4	2,100	Total.....		1,609,926

## PERSONS ENGAGED IN THE SHORE WHALE FISHERY IN ALASKA IN 1917.

Races.	Number.
Whites.....	188
Natives.....	30
Japanese.....	44
Total.....	262

## PRODUCTS OF ALASKA SHORE WHALING OPERATIONS IN 1917.

Products.	Quantity.	Value.
Whale oil.....gallons..	900,883	\$438,362
Sperm oil.....do....	197,670	149,270
Fertilizer, meat.....pounds..	1,668,000	47,380
Fertilizer, bone.....do....	312,600	14,340
Whalebone.....do....	14,866	5,500
Total.....		654,852

## CLAM FISHERY.

The clam industry of Alaska is centered at Cordova, where two canneries were operated in 1917, one each by the Pioneer Packing Co. and the Lighthouse Canning Co., which latter concern was formerly known as the Lighthouse Canning & Packing Co. This was the first company to undertake clam canning at Cordova, operations having been started in improvised quarters in 1916. Before the digging season opened in 1917 a new building 50 by 100 feet was erected, to which the machinery was transferred.

Early in 1917 the Alaska Sea Food Co. acquired the one-line cannery built in 1916 near Point Whithed, about 9 miles east of Cordova, and began canning operations in March. On April 4, after about 400 cases had been packed, the cannery was destroyed by fire. Reconstruction began immediately, and a modern plant was soon erected



and equipped with one line of machines, but operations were not resumed.

The Pinnacle Rock Packing Co., also a new concern, erected some small buildings at Boswell Bay and made other preparations for canning clams. Operations, however, were not commenced. The Kodiak Fisheries Co. packed a few cases of butter clams at Kodiak, and a few were also packed in southeast Alaska at Sitka by the Sitka Packing Co.

This industry shows an investment of \$294,987, which is a gain of \$137,044 over 1916. It gave employment to 226 persons, as compared with 78 in 1916. A total of 74,515 cases were packed, as against 10,093 cases in 1916. The value of the clam products was \$274,036, as compared with \$35,622 in 1916, an increase of \$238,414 for 1917.

#### INVESTMENT IN THE CLAM-CANNING INDUSTRY IN ALASKA IN 1917.

Items.	Number.	Value.
Canneries operated.....	2	\$51,242
Working capital.....		126,850
Wages paid.....		97,200
Vessels:		
Over 5 tons, power.....	1	6,586
Tonnage.....	25	
Launches under 5 tons.....	11	7,493
Rowboats and skiffs.....	46	4,708
Scows.....	1	908
Total.....		294,987

#### PERSONS ENGAGED IN THE CLAM-CANNING INDUSTRY IN ALASKA IN 1917.

Occupations and race.	Number.
Diggers: Whites.....	158
Shoresmen: Whites.....	65
Transporters: Whites.....	3
Total.....	226

#### PRODUCTS OF CLAM CANNERIES IN ALASKA IN 1917.

Products.	Number cases.	Value.
Clams:		
½-pound flat cans (48 per case).....	30,827	\$100,257
1-pound tall cans (48 per case).....	<sup>a</sup> 41,087	165,410
2-pound tall cans (24 per case).....	1,867	6,534
Clam juice:		
2-pound tall cans.....	682	1,705
10-pound tall cans.....	52	130
Total.....	74,515	274,036

<sup>a</sup> Includes 10 cases packed in southeast Alaska.

## MINOR FISHERIES.

## TROUT.

An appreciable increase in the production of Dolly Varden and steelhead trout in Alaska occurred in 1917. It is noteworthy that the value of these products was \$16,896, as compared with \$6,935 in 1916. The Midnight Sun Packing Co., at Kotzebue Sound, leads in production, having canned 1,064 cases and pickled 144 barrels of Dolly Vardens. In 1916 there were 530 cases canned and 17 barrels pickled. The quantity of fresh and frozen trout shipped from southeast Alaska in 1917 was 7,798 pounds, as against 50,822 pounds in 1916.

## PRODUCTS OF THE ALASKA TROUT FISHERY IN 1917.

Section and species.	Frozen.		Fresh.		Pickled.		Canned.	
	Pounds.	Value.	Pounds.	Value.	Barrels.	Value.	Cases.	Value.
Southeast Alaska:								
Dolly Varden.....	2,470	\$141	28,697	\$2,836			3	\$18
Steelhead.....	5,328	560	6,471	481				
Total.....	7,798	701	35,168	3,317			3	18
Central Alaska:								
Dolly Varden.....					17	\$255	269	2,009
Steelhead.....							24	152
Total.....					17	255	293	2,161
Western Alaska:								
Dolly Varden.....					157	1,644	1,112	8,800
Grand total....	7,798	701	35,168	3,317	174	1,899	1,408	10,979

## SABLEFISH.

The production of sablefish, or black cod, as it was formerly known, was increased threefold in 1917 over that of 1916, thus indicating that there is an increasing demand for this highly nutritious fish and that it is coming into more general favor. The frozen product represents more than half of the catch, while the quantity shipped fresh was almost one-third of the total production. In 1916 a total of 304,141 pounds, valued at \$11,185, was produced, as compared with the production of 1917 of 1,020,490 pounds, valued at \$38,303. This is an increase in quantity of 716,349 pounds and in value of \$27,118.

## SHIPMENT OF SABLEFISH FROM ALASKA WATERS IN 1917.

Condition.	Pounds.	Value.
Fresh.....	305,804	\$9,695
Frozen.....	574,715	21,989
Pickled.....	139,971	6,619
Total.....	1,020,490	38,303

## RED ROCKFISH.

The red rockfish continues to grow in popular esteem as a food fish. This is evident from the fact that a considerable quantity was frozen by the larger companies operating cold-storage plants in Alaska. With the establishment of a trade in rockfish, fishermen will find it profitable to save all such fish, which heretofore have been thrown away in large numbers, not only because they were of little value, but in order that all space in the fishing vessels might be filled with halibut. In proportion as the demand for halibut exceeds the supply the cheaper and hitherto neglected species will be utilized.

The production of rockfish in 1917 was 150,453 pounds, valued at \$3,696, as compared with 45,200 pounds in 1916, valued at \$1,294. Of this amount 19,350 pounds were sold fresh for \$1,075 and 131,103 pounds, valued at \$2,621, were frozen.

## SHRIMPS.

The Alaskan Glacier Sea Food Co., at Petersburg, pickled 65,000 pounds of shrimps, valued at \$3,400. This output is slightly less than in 1916, when the total value of shrimp-fishery products was \$3,750.

## CRABS.

No more delectable food comes from the waters of Alaska than crabs; yet, notwithstanding their wide distribution, they are taken commercially to a very limited extent, and but two localities are reported as having produced any. According to available returns a total of 360 dozen, valued at \$540, was taken at Tenakee, while 50 dozen, valued at \$125, were marketed at Cordova. There is also some local use of crabs by fishermen and others at various places.

## SHARKS.

The Bureau has been calling attention to the possibilities of a profitable shark fishery. This applies to the waters of Alaska as well as elsewhere. The Bureau is prepared to furnish definite information to interested persons in respect to the preparation of hides of sharks for the tanner. It has been clearly demonstrated that shark hides furnish a desirable grade of leather. The carcasses may be worked up into oil and fertilizer. It is essential that due care be exercised to avoid cutting holes in the hides during the process of skinning, as every hole in the hide lessens its value.

The Marine Products Co., with headquarters at Seattle, Wash., has made an effort to interest fishermen and others in southeastern Alaska to the end of securing sharks. In a circular issued by the company on January 2, 1918, it was pointed out that the market value of shark-liver oil in barrels, delivered at Seattle, was then from 55 to 75 cents per gallon. It was stated that No. 1 shark skins, over 6 feet in length, were worth 12 cents a pound, while No. 2 skins, under 6 feet in length, were worth 11 cents a pound. It was stated that shark meat dried, rough, unground, in sacks, at Seattle, was valued at from \$50 to \$60 per ton of 2,000 pounds.

Sharks may be taken in considerable numbers in various places in southeastern Alaska. The fishing gear employed especially for taking sharks is not unlike that used in the halibut fishery. It is said by the Marine Products Co. that the ground line should be either 48-pound tarred line or three-eighths cotton line, and that No. 15-0 Cirby japanned hooks set every 6 fathoms well fastened to a light flexible galvanized wire ganging, not over 3 feet long, should be used. It is said that experience has demonstrated that 300 fathoms of gear containing 50 hooks is sufficient for a set. It should be held with two regulation halibut anchors and buoyed with three or four floats. Sets should be made preferably on muddy bottom and allowed to remain from three to five hours in the daytime and throughout the night if set in the evening. It is said that salmon heads are the best bait, but that halibut heads or fresh fish of any kind will be suitable. In view of its possibilities, it would seem that the shark industry ought to be developed much more actively than has been the case heretofore.

#### MISCELLANEOUS FISHERY PRODUCTS.

Probably every food fish taken in Alaska has at the present time some commercial use. In part limited utilization may be due to a lack of suitable fishing gear required for the capture of a considerable quantity of fish, but as the quality of the somewhat neglected species becomes known a demand for them will be created which in turn will cause attention to be given to an improvement in methods of fishing whereby production may be augmented.

Prominent among the little utilized species are the smelt, ling cod, eulachon, tomcod, flatfish, and atkafish. The atkafish, or greenling, is a fish of recognized food value and one whose exploitation is worth undertaking. That it is not known to be generally abundant except in the extreme western part of Alaska, particularly the Aleutian Islands, is a factor which must be reckoned with in connection with the possibility of its development into a fishery of commercial importance. The isolation of the region is sufficient to close it to that class of operators who would be most likely to do the prospecting or pioneering. At present only residents of the region, or companies established in other industries in western Alaska, have access to the most promising fields, as the cost of laying down supplies at Unalaska with the means now provided by public carriers would be prohibitive. Excepting one company, none of those engaged in the salmon industry in western Alaska has attempted to develop the atkafish fields. In due time the companies engaged in the cod industry may find opportunity to investigate the possibilities of this fishery.

In 1917 the total production of miscellaneous fishery products in Alaska was 114,167 pounds, valued at \$2,247.

## MINOR FUR-BEARING ANIMALS.

### FIELD WORK.

The field activities of a number of wardens was given almost exclusively to the enforcement of the law and regulations for the protection of the fur-bearing animals in Alaska exclusive of the Pribilofs. Other wardens as well as other officials also gave attention to these matters as far as was compatible with their other duties. The constantly increasing work which the Bureau is called upon to do not only in connection with the fisheries but with the fur-seal work as well makes it difficult to give as much attention to matters pertaining to the minor fur-bearing animals as is desirable.

In the latter part of the year a special warden was appointed at a nominal salary to attend to the Bureau's interests at Anchorage and in the adjoining region.

### REGULATIONS.

No change was made in the departmental regulations for the protection of fur-bearing animals in Alaska in 1917. The regulation promulgated in 1916 affording entire protection to martens from March 15, 1916, to November 15, 1921, first imposed an actual change, from the conditions previously obtaining, in the trapping season of 1916-17. (Previous regulations had prohibited the trapping of martens each year from March 15 to November 15.) The new regulation was in general favorably received and observed.

The practice of having open seasons for various fur-bearing animals not coinciding exactly in time is open to the objection that traps lawfully set for taking certain species may take individuals of species whose capture is at the time forbidden. On this account it has been recommended that the open season for all fur bearers begin and end on the same dates. It is possible to conceive that a single period of time could be fixed upon as the open season for all protected fur bearers which would fairly take into account the various factors involved, such as breeding seasons, condition of pelage, the giving of a fair opportunity to trappers to operate, etc. The problem is complicated, however, because at times it is desired to afford complete protection to some species for a period of years.

Considerable attention was given to the question as to whether the killing of beavers should be permitted after November 1, 1918, the date when the close season as fixed by the existing regulations would expire. The complete protection afforded these animals in recent years has enabled them to reestablish themselves to a very gratifying extent. It was felt, however, that the reestablishment was more or less local in character, and that it should become more general before an open season was permitted. Furthermore, the colonial habits of the animals make it easy for trappers to practically exterminate whole settlements and it was understood that some persons had in mind the possibilities for taking beavers which would

exist as soon as the anticipated open season began. Recommendations which were received in regard to the matter were practically unanimous in expressing the hope that a longer period of protection be given the animals. Accordingly, early in 1918 the Bureau made a recommendation to the Secretary of Commerce that the existing close season be extended to November 1, 1923, which was approved by him on March 4, 1918.

#### FUR FARMING.

For a number of years the Bureau has published in the reports of the Alaska service information in regard to fur-farming operations in Alaska with the view of making a matter of record the status and progress of this comparatively new business and to stimulate possibly the efforts of individuals engaged in this work through a formal recognition of their activities. The Bureau has no jurisdiction over the fur-farming business aside from seeing that the law and the regulations promulgated by authority thereof are enforced. The law, aside from matters pertaining to the fur-seal fisheries, is concerned wholly with acts which involve or follow the killing of fur-bearing animals. The Bureau has no funds whereby it may carry on any experiments in fur farming in Alaska. About the only help, therefore, that the Bureau can render fur farmers is to aid as best it may in securing for them information in regard to the business.<sup>a</sup> Attention is in this connection invited to the work of the Department of Agriculture. The Bureau of Biological Survey of that Department is interested in the propagation of fur-bearing animals and has an experimental fur farm in northern New York. Its publications on fur farming are of decided interest.

The data which the Bureau of Fisheries secures in regard to fur farming in Alaska are obtained largely in an incidental way by employees while engaged in their formal work and by means of direct correspondence between the Bureau and fur farmers, who quite generally furnish freely information in regard to their operations. In publishing accounts of fur farms from year to year the Bureau aims chiefly to give new information which has become available.

Fur farming in Alaska is in most cases concerned with the breeding and rearing of foxes. Some attention has been given to minks and martens, and there are records of martens having been born and reared in captivity in the Territory. Skunks and raccoons have been introduced into southeastern Alaska, but nothing is known as to the success attained nor as to the reasons which led to the choice of these animals as objects of fur farming in Alaska.

A report for the season 1916 and 1917, furnished by George L. Morrison, of Hot Springs, in regard to a fox farm at Hot Springs in which he is interested, is in part as follows:

We ranched 24 pairs of foxes, of which 5 pairs were crosses, 18 pairs were silvers, and 1 pair whites.

From the 24 pairs we had 15 litters born. From the 15 litters we lost 2 litters of 5 each, one mother having buried her young trying to conceal them after having been frightened and another having lost her young on account of insufficient nourishment

<sup>a</sup> Note is made here of the authority of the Department of Commerce to lease a number of islands in Alaska for the propagation of foxes and other fur-bearing animals. A number of the islands are already under lease.

for them. After losing 3 in another litter of 6, we took the other 3 away from the mother and raised them successfully by hand.

From the 15 litters there were 60 pups, of which we raised 35 silvers, 6 crosses, and 2 reds to maturity. The first litters were born April 25 and the last one May 30.

Our principal food is fresh and dried salmon, horse meat, wild game, rice, milk, and eggs.

We will retain 29 pairs of silvers and 1 pair of crosses this year. This pair of crosses proved to be breeders of exceptionally good stock, giving us 2 dark silvers this year.

Our ranch is located about 1,000 feet east of the town of Hot Springs, Alaska, on a sand ridge in a thick growth of cottonwood, birch, and spruce, which furnish shade in summer and shelter from the cold winds in winter. Our outside inclosure is about 300 feet square, built 12 feet high with overhang of 30 inches, and a 6-foot galvanized carpet wire, 16 gauge, which prevents the animals from burrowing under and escaping. The first 6 feet of the fence is of 14 gauge 2-inch mesh galvanized wire; the top 6 feet is of 16-gauge 2-inch mesh, also the overhang. We might say here that we have never had a fox escape from this inclosure, and from our experience we believe a 10-foot fence would be perfectly safe.

Our breeding pens are built 70 feet on two sides from the outside fence and 50 feet from the other two sides. Thirty pens were built in 1915, size 37 by 37 of the same material and height of outside inclosure. In these pens a 3-foot 14-gauge wire is sunk in the ground and only a 3-foot carpet wire is used. Six-foot alleyways were left on two sides of each pen, and 8-foot on the other two sides. These wide alleys are quite essential to prevent the spread of disease and to keep the foxes from being annoyed at whelping time by animals in the near-by pens.

This year we added 30 more pens, 6 by 37 feet, built in the 6-foot alleys on each large pen. These pens are to be used for separating the foxes in case of sickness or to take the male away after mating in case he should be greedy or not a good parent, also to keep the young after they have been separated from the mother until they are mated, sold, or their pelts taken.

The principal losses among our young foxes are due to stomach and bowel disorders, due we believe to improper food and feeding. We are, however, overcoming this trouble to a considerable extent and in the future look for only a small percentage of loss.

We have recently taken the pelts from 16 silvers, 21 crosses, 2 reds, and 3 whites. These pelts are all exceptionally well furred, although we do not expect fancy prices this year for our silvers, as they are of our poorest stock.

Wenzel & Son, of Fairbanks, established a fox farm at Monument Point in 1915. On December 5, 1917, the stock on hand consisted of 3 male and 1 female red foxes, 2 male and 6 female cross foxes, 6 male and 12 female silver-gray foxes, a total of 30. In 1917 two litters were born. These animals consisted of 3 male and 2 female crosses and 2 male and 2 female silver grays. No animals were killed on the farm in 1916 or 1917.

The original stock for the farm was secured by trapping. It appears that with the exception of the use of bear meat for short periods on two occasions the foxes have been fed exclusively on salmon, fresh salmon being cooked and smoked salmon soaked before use.<sup>a</sup> Plenty of fresh water is furnished at all times.

W. J. Vachon is the owner of a fox farm located at Tolovana, Alaska. This farm was established in 1912 and the original stock was purchased. On January 5, 1918, the stock on hand consisted of 11 male and 11 female, all silver grays. In 1917, 3 litters were born on this farm. The total number of young was 18, 9 male and 9 female, all silver grays. In 1917, 29 foxes were killed on this farm, 17 male and 12 female, all silver grays. In the same year 1 animal was killed from fighting and 3 died from disease.

The structures for carrying on operations include an outside inclosure, 550 feet by 185 feet, within which there are upwards of 50 pens of various sizes. The foxes are fed fish cooked with corn

<sup>a</sup> The Bureau suggests that fur farmers exercise caution in using smoked food, at least until they have demonstrated that harmful results will not ensue.

meal, bone meal, crackers or rice, and fresh meat when obtainable. This farm is situated about 500 feet from the Tanana River on a sandy knoll, well-sheltered from wind.

In addition to his fox-farming operations, Mr. Vachon is also interested in the propagation and rearing of martens. The work was taken up at Tolovana, Alaska, in 1914. Presumably the experiments have been carried on with one pair of animals as a breeding stock, but definite information on this point is lacking. At any rate no young were born in 1915 or 1916. On April 29, 1917, a litter of four was born, two males and two females. It is said that these young were without hair at birth and that it was 29 days before they opened their eyes. The parents were separated some time before the young were born. The mother continually carried the young martens from one place to another until they were about two months old. All were reared to maturity, since which one has died. The food used is dried and fresh fish, scraps of meat, and birds.

L. G. Michael, Franklin, secured in 1917 from 4 pairs of foxes three litters, 2 of five and 1 of four. Starting in 1915 with 1 pair of foxes, Mr. Michael has raised 25 young foxes in three years. In November, 1917, he had a stock of 26 animals; 1 silver, 6 reds, and 19 crosses. He expected, however, to retain only 5 or 6 pairs. He had six corrals, 40 feet by 40 feet, with double compartment coops and artificial burrows in each, and planned to build three more. In regard to feeding foxes, the following is taken from Mr. Michael's report:

I feed wild game principally, mostly rabbits, some fish, and wild berries, with an occasional ration of cooked food. Boiled meat scraps with stock thickened with rolled oats makes a food which they relish very much. Any bones, such as caribou and moose heads and legs, give them something to gnaw at. Two or three weeks before they are expected to whelp, I give the females about a pint of milk a day aside from their regular ration. I give them milk until the young are weaned. As soon as the young are big enough to come out of the coops, I give them a little milk three times a day, and a very little solid food at first, although I see that they have heavy bones with but little meat on to gnaw at.

W. H. Newton, of Healy River (Richardson post office), has continued experimental work but without a great deal of success. However, in 1917, he built some new pens and expected to continue the work.

Joseph Voelkl, 18 Mile Post, Haines. From a report made by Mr. Voelkl in October, 1917, it appeared that he had a stock of eight foxes (one black silver, five crosses, and two reds) and nine mink, six of which were young.

A. C. Smith, Porcupine, Chilkat Valley. Mr. Smith commenced fox-farming operations with Pete Duncan at Wells in 1914. The partnership was subsequently dissolved and Mr. Smith moved the two animals on hand to Porcupine. Additional animals were secured by purchase and capture. The record at hand does not indicate that any young have been reared. The foxes are fed fish, vegetables, table scraps, corn meal, and meat.

E. Hillenbrand, Pleasant Camp, Chilkat Valley, began operations in July, 1915, with four foxes, one cross and one red male, and one black and one cross female, secured by purchase and capture. While the operations have been continued, it is not known that any young born on the farm have been reared.



Otto Kraft & Son, of Kodiak, have continued their farm on Svitolak and Middle Islands, Kalsin Bay, about 15 miles from Kodiak. The firm began its operations in 1916 with animals born that year, and the year 1917 was necessarily one for carrying along the work and awaiting definite results. Fresh and dried fish are used for food; also salted salmon heads, the salt being all soaked out before the material is used.

Alex. Friedolin, of Afognak, has a fox farm on Hog Island, which is in Marmot Bay and from 3 to 4 miles from Afognak village. In November, 1917, Mr. Friedolin reported that his breeding stock consisted of four pairs of blue foxes. There are no corrals on the island, the foxes being allowed to run at large. The foxes are fed, at least in the winter, and one small building is used for the purpose of keeping food where they may go and help themselves.

Some few years ago Mr. Friedolin turned loose on Hog Island 14 field mice, hoping that they would multiply and furnish food for foxes. It is reported that the mice have increased wonderfully, that the island is alive with them, and that their food requirements have noticeably affected the vegetation growing there. It has been noted that the foxes dig for the mice here and there, and probably catch them in the open, but without any appreciable effect upon their numbers.

John Tashwak, of Afognak, continued his efforts on a small island near Afognak Island. The foxes are allowed to run at large and some have escaped by swimming to Afognak Island.

Peter J. Petrovsky, of Uyak, continued operations on Amook Island. A number of foxes have been kept in corrals or pens and a few young from these were reared in 1917. Difficulty was experienced in that a number of young were killed by their parents. The owner also had some foxes at large on Amook Island.

Frank Peterson, of Uyak, has a fur farm at Ayakulik River, west coast of Kodiak Island. From reports received from him it appears that he is making experiments with foxes in corrals built on the mainland of Kodiak Island, obtaining part or all of the animals from stock belonging to him and running at large on an island near the mouth of Ayakulik River.

A firm of which J. G. Carson, of Katalla, is a member has a fox farm on Wingham island. A report made by Mr. Carson early in February, 1918, stated that the breeding stock consisted of six pairs of foxes, silvers and crosses. In 1917 six young were raised from two females, both bred to the same male. All that were born in these two litters were raised. Trouble was experienced at this farm in 1916 and again in 1917 on account of foxes dying. One of the members of the firm thought that the fatalities were due to the feeding of dried smoked salmon, the creosote being harmful. At the time the report referred to above was written the use of dried salmon had been stopped. Foods in use were hair-seal meat, Belgian hares, fresh fish, canned salmon (light weights), fresh beef, eggs, Spratt's dog biscuits, and bread.

For a number of years the firm also kept martens at this farm endeavoring to propagate them. Owing to difficulties encountered in impennening them they were finally removed from the island in July, 1917.

It is understood that Andrew Sholin, Homer, via Seldovia, is engaged in silver-fox farming, but details in regard to his work are not at hand.

Joseph Filardeau, of Seldovia, began fox farming in 1915 with one pair of foxes. The results obtained have warranted him in continuing his work. In November, 1917, Mr. Filardeau advised that he had entered into partnership with Mr. J. A. Herbert and that they had eight pens in the course of construction and expected to have ten pairs of breeding animals in 1918. In referring to a litter of five silver grays, Mr. Filardeau states:

These were also raised without getting seriously sick. In July it was noticed that they were not so active as they generally were, which fact caused me considerable anxiety, prompting me to gather herbs of all varieties and give them to the animals in the hope that they would contain something of benefit to the foxes. No improvement was noticed, however, until some bunches of green sod were given, the roots growing therein appeared to be greatly relished and the immediate change that followed was unmistakably for the better.

Andrew Siewertson, of Latouche, has a fox farm on Perry Island, Prince William Sound. Two pairs of blue foxes were placed on the island in 1915. In October, 1917, the owner reported that breeding operations had not been very successful and that he was putting on his island two additional pairs secured from the Naked Island fox farm.

Stanier & Van placed four pairs of blue foxes on Axel Lind Island, Prince William Sound, in 1916. The animals were secured from fox farmers. In 1917 about six foxes were raised. The owners feel that the outlook for handling a large number of foxes is not very encouraging on account of the difficulties involved in securing supplies of fish for fox food in the face of competition for salmon for cannery use. They suggest the setting aside of a fishing ground for the use of fox farmers.

Lilzegren & Wagner have a fox farm on Little Naked Island, Prince William Sound. The foxes originally put on the island by them consisted of two pairs of blue foxes placed there in 1913. In 1914 about 10 young were raised; in 1915, about 30; in 1916, about 60; and in 1917, about 90. In 1915, 8 foxes were killed for their pelts, and in 1916, 29. Six live animals were sold in 1916. The owners expected to kill, if conditions were favorable, about 35 in 1917. Messrs. Lilzegren & Wagner feel as other farmers in this region that the question of a future supply of fish being available for use as fox food is one which should receive attention, and recommend that fox farmers pay a reasonable tax and in return have a small fishing ground set aside for their use.

F. A. Shumaker, of Latouche, and A. Lund operate jointly a fox farm on Long Island, Prince William Sound. Eighteen blue foxes, 10 females and 8 males, purchased from A. Grosvold, Sand Point, Alaska, were placed on the island in September, 1913. Forty foxes were raised in 1914, 60 in 1915, 80 in 1916, and 85 in 1917. Mr. Shumaker reported that the foxes in 1917 were too numerous for prolific breeding and that it was planned to take from 75 to 100 pelts. No pelts were taken in the years from 1913 to 1916, inclusive. One pair of live foxes was sold in 1915 and two pairs in 1916. While at present the facilities for obtaining food for the foxes on this island are satisfactory, Mr. Shumaker stated that it was getting more difficult each year for the fox farmers in the region to secure a proper

amount of food for the animals in the vicinity, and questioned whether it would not be possible to have fishing sites set aside for their use.

James McPherson, of Ellamar, occupies Peak and Naked Islands, Prince William Sound, for fox-farming purposes. It appears that the original stock consisted of four blue foxes secured from the Alaska Commercial Co. and put on one or the other of these islands in October, 1897. From records at hand it would seem that this farm has produced a considerable number of foxes annually for many years. For instance, from 1900 to 1910 the number of foxes raised each year averaged about 70. Subsequently there was a falling off for a few years. This was followed by a rise, about 90 being raised in 1915, about 85 in 1916, and about 60 in 1917.

W. C. L. Beyer and Thomas Davis placed 12 blue foxes, 7 females and 5 males, on Fairmount Island, north shore of Prince William Sound, in October, 1917. These operations are in a way a renewal of earlier ones on the part of Mr. Beyer, who states that he started work on the island in 1895 with five pairs of blue foxes. He was obliged to leave the island in 1904 and subsequent dependence upon hired help apparently demoralized the business. From other records it would appear that Fairmount Island was occupied for fox-farming purposes as early as 1897 or 1898.

J. D. Jefferson, Valdez, in April, 1917, placed three pairs of blue foxes on Bald Head Chris Island and three cross foxes on the Dutch group of islands. All these islands are in Prince William Sound. No increase was expected the first season. In November, 1917, the stock was reported thriving.

Additional information in regard to fur farms will be found in the review in this report of fur farming in southeastern Alaska, also in the section in regard to islands which may be leased by the Department of Commerce for the propagation of foxes and other fur-bearing animals.

#### REVIEW OF FUR FARMING IN SOUTHEASTERN ALASKA.

In the corresponding report for 1916 <sup>a</sup> there were published extracts from a report submitted by Inspector Walker in regard to fur-farming possibilities in southeastern Alaska. Mr. Walker continued his work of collecting data, and extracts from a subsequent report submitted by him are printed below. The report had reference to conditions and possibilities existing in southeastern Alaska, and was based on studies made and information obtained there, and the reader is cautioned against applying the conclusions to Alaska generally unless warranted by other information. Furthermore, it must be borne in mind that the business of fur-farming in Alaska, except perhaps in a few instances, is far from being established on a paying basis; that present-day operations are largely experimental; that the ultimate success of the business is not fully assured, and that statements made in regard to the future are largely deductions of individuals. Extracts from Mr. Walker's second report follow:

The history of fur farming in southeastern Alaska is, with one exception, a history of failures rather than successes. The questions that naturally follow are: Why has almost every attempt resulted in failure? Is it because the region is not suited to the enterprise?

Justice to the country demands that the true causes of the failures be made public, and after studying the subject from all possible viewpoints the conclusion has been reached that the failures in fur farming in southeastern Alaska have been due to the three following causes, which can in no way be charged against the industry or the region:

First. Neglect due to irresponsible drinking men being left in charge, who either failed to care for the animals or allowed them to be poached off.

Second. Persons going into the work with the idea that it would prove to be a "get-rich-quick" proposition, then becoming discouraged, running short of money and going out of business, or neglecting the animals after two or three years when they discover their mistaken idea.

Third. Perhaps a portion of the failures have as a partial cause the lack of experience and knowledge of how to handle the animals, but such trouble if had by responsible, determined men would have been charged to experience, and they would have in the future profited thereby and in the end been successful.

Some persons might believe that a certain percentage of the failures has been due to parties starting into the work without sufficient funds to carry it to a successful self-sustaining stage. This belief is true, but the situation is fully covered in the second of the reasons given for failure. Referring to the third reason given for failure, it may be said that much that is charged to lack of knowledge and experience could have been avoided by careful study, judgment, and the use of common sense. So in the end the cause of the failures may almost without exception be laid to neglect from one cause or another.

At present there is but one fur farm in southeastern Alaska that has been sufficiently long established to show its permanency and merit the name of a fur farm. This is the blue-fox ranch of James York, on Sumdum Island, which has been in operation for 19 years and is now on a firmly established basis. The blue foxes on this island have the run of the entire place, and it can not be said how many animals there are.

As a whole those attempting fur farming other than with blue foxes have been hunters, trappers, prospectors, and others who have obtained for their stock local wild animals. These persons have taken up the project as a side line and when for any cause any of their work was neglected it was the animals that suffered.

The greatest number of attempts to operate fur farms have been with red foxes, and of these there have been no less than eight, as follows:

Name of owner.	Location of farm.	Began operations.	Present status.
E. H. Richter.....	Skagway & Dyea.....	1913	Out of business.
Tom Lahey.....	Long Bridge, Chilkat Valley.....	1913	Do.
Pete Duncan.....	Wells, Chilkat Valley.....	1914	Do.
John Morrison.....	Haines.....	1913	Do.
Joseph Voelkl.....	18-Mile Post, Chilkat Valley.....	1915	Has 8 foxes.
E. Hillenbrand.....	Pleasant Camp, Chilkat Valley.....	1915	Has 2 foxes.
A. C. Smith.....	Porcupine, Chilkat Valley.....	1915	Has 6 foxes.
Barkdahl & Green.....	Sokol Island.....	1916	

Mink and marten farmers are next in numbers or perhaps even in greater numbers than the fox raisers, but the operations are less conspicuous and many have probably not come to notice:

Name of owner.	Location of farm.	Began operations.	Present status.
Bert Maycock.....	Windfall Island.....	1915	Unknown number of martens at liberty and doing well.
John Fanning.....	Etolin Island.....	1916	Estimated 25 martens on small island.
C. H. Barkdahl.....	Sokol Island.....	1904	Out of business.
— Johnson.....	Sitka.....	1913	
Simon Catt.....	Fanshaw Anchorage.....	1913 or 1914	
Joseph Voelkl.....	18-Mile Post, Chilkat Valley.....	1915	Has 9 mink.
Lewis Long.....	The Brothers Islands.....		Abandoned.

Third in number of operators come the blue-fox farmers on islands, of which there have been five attempts:

Name of owner.	Location of farm.	Began operations.	Present status.
James York.....	Sumdum Island.....	1899	Successful.
Pride & Jones.....	Hound Island.....	1905	Abandoned.
Geo. Schove.....	Patterson Island, then moved to The Brothers Islands in 1904.		Do.
C. H. Barkdahl.....	Sokoi Island.....	1905	For a time practically abandoned, but recently taken up again for further work. May be some of original stock remaining.

In addition to the above, there have been numerous single animals confined in hopes that mates for them might be obtained, usually resulting in the animals dying, being killed for fur, escaping, or being sold alive to others attempting fur farming.

Skunks and raccoons have been introduced on "Brothers Islands," but nothing has been heard of the matter recently, and it is not known as to the success. Considering the price of these skins as compared with those of some of the native fur bearers, which should be no more difficult to raise, no advantage can be seen in such a project unless the saving in feeding in winter proves to be decided.

The animals that are most available to the majority of persons in the region are minks and martens. The latter can perhaps be successfully kept on small islands if they do not fight among themselves too much. If they do prove to fight seriously when on small islands it will of course be necessary to pen them. Minks, being daring swimmers, must be penned. There is not a portion of southeastern Alaska where food is obtainable for these animals that is not suitable for them.

The red fox, with its color phases, is commonly indigenous only to that portion of southeastern Alaska west of Lynn Canal and north of Icy Strait, although they occasionally approach salt water farther south on the mainland by following down some of the larger streams and valleys. Of all southeastern Alaska only that portion in which red foxes naturally occur is to be considered for red-fox farming, and of this the section having the best combination of natural resources and advantages is the Chilkat Valley. Some of these advantages are: A climate approaching that of an interior country, in that it is clear and cold in winter and warm and dry in summer; the rainfall is the least of any portion of the district; there is an easily accessible food supply, as the fish are, or should be, abundant in the Chilkat River which flows through the valley; there is perfect drainage by reason of the sandy soil: large and permanent pens may easily be constructed because of the sandy soil underlaid at an average of about 3 feet by a hard subsoil of clay, through which foxes could scarcely dig out under the fences; the valley is easy of access both summer and winter; it is the natural home of the fox, and fortunately is in a region in which melanism is prevalent, thus producing a considerable percentage of dark individuals even from red parents; the climate while close to salt water is of an interior character which will produce fur of a superior quality, surpassing that possible on the coast and islands.

As noted above, a recent attempt has been made to introduce red foxes on Sokoi Island, near Petersburg, but at present it is too early to say with what success the project is attended. The writer firmly believes that the islands are much too wet for red foxes to do well and the salt atmosphere will certainly coarsen and dull the fur more than is desirable.

The arctic or blue fox is not native to any portion of the region, but seems to have done well at every place it has been introduced so far as the climatic conditions and food are concerned. Almost any of the small islands are suitable for the raising of these animals, and the food for them may be the same as for the other animals save that as they roam at large on the island they are able to pick up more or less food for themselves from the beach and woods.

Beaver and land-otter farming have not been attempted in the district and little can be said regarding the subject. In regard to beavers, a peculiar terraine would be necessary and fencing would prove to be expensive. Land otters would require fencing, but they could be fed almost wholly from the sea foods to be had in such abundance at almost every front door in the region.

The isolated farmer should be able to supply his animals with food mainly from the ocean and streams by keeping a skate or two of halibut gear, and a crab trap or two and nets in operation near his place. The sea-food diet can be varied frequently. In season, waste scraps from deer killed for food would help out on the feeding problem. Eagles which are being killed for the bounty might be acceptable and in certain sections squirrels are obtainable in limited numbers. By a little ingenuity in their capture, mice and voles of numerous species could help vary and supplement the food. In the Chilkat Valley rabbits are obtainable some of the time.

For the farmer in or near settlements fish heads and scrap fish from the halibut fisheries and salmon canneries would almost always be available. Some butchers' scraps might also be obtainable, and many of the foods mentioned as being available to the isolated farmer would be almost as accessible to those at settlements.

Anyone undertaking the business of fur farming in southeastern Alaska or elsewhere should begin with the idea that for at least the first five years little or no profits will be realized, and that constant care and attention will be required if the industry is to be brought to a profitable stage. Fur farming must be looked upon as like any other live-stock raising. If one is expecting to build up and increase his stock he must not sacrifice the breeding animals for immediate gain.

In attempting fur farming in this region one should plan to follow either one or the other of the following courses: Arrange to have sufficient funds to carry on work for at least five years without expectation of income from the industry, or begin with only a few animals, kept as one would keep pets, giving them all necessary attention with no expectation of profit for some years. If one is to make a success in following such a course as the latter he must not neglect the care and attention of the animals even in the greater struggle of making the immediate living, for this has been the cause of failure in many cases of similar character in the past.

Poaching has been a menace to fur farming, but with industrious, determined farmers there would be little opportunity for the poacher to ply his trade.

Summarizing, it may be said that opportunities for the fur farmer in southeastern Alaska are almost unlimited, but that it is not a royal and short road to riches, and one going into it must expect to sacrifice and work as he would in any other live-stock raising. Aside from the blue foxes, the native fur bearers probably offer the best stock with which to start. Every possible encouragement and facility should be accorded the prospective fur farmers to obtain and acquire title to land on which to conduct fur farming.

### SHIPMENT OF FURS FROM ALASKA.

For several years the Bureau has collected statistics of furs shipped from Alaska. It is required of shippers by departmental regulation that all shipments of furs from the Territory shall be reported to the Bureau of Fisheries.

By far the largest number of fur shipments from Alaska is made by mail. The Post Office Department has cooperated all along with the Bureau in the way of seeing that fur shipments by mail were properly reported. In 1917 that Department reaffirmed its willingness to cooperate, and under date of May 4, 1917, the Postmaster General issued an order which, while modifying somewhat the previous method of procedure, undoubtedly placed the matter upon a more satisfactory basis. The order is as follows:

*Furs shipped out of Alaska by mail.*

OFFICE OF THE POSTMASTER GENERAL,  
Washington, May 4, 1917.

The following instructions will become effective on October 1, 1917. Before that date, the Department of Commerce will have supplied to Alaska postmasters the blanks for a new form of report to be used by persons mailing furs to points outside of that Territory:

It will be the duty of each postmaster in Alaska, on and after October 1, 1917, to furnish the report blanks to persons who present furs for mailing and to see that no furs are sent through his office to outside points until after the shipper has filled out the blank and signed the certificate as to the correctness of the report, and the postmaster has placed his signature under the words "Transmitted to the Commissioner of Fish-

eries, Washington, D. C." The postmaster will then dispatch the shipment of furs as addressed, without examining the contents for the purpose of verifying the shipper's report, and will mail the report under cover of an official penalty envelope addressed "Commissioner of Fisheries, Washington, D. C."

Postmasters should not permit their supplies of the report form to become exhausted, but in due time should make requisitions upon the Commissioner of Fisheries for specific quantities.

The present system of reporting fur shipments will remain in effect through September 30, 1917.

A. S. BURLESON,  
Postmaster General.

Furs were formerly the most valuable product of Alaska, and while they have yielded to the products of the mines and the fisheries the absolute value of the annual output is large.

The following table shows the detailed statistics as compiled from information furnished the Bureau in regard to the furs shipped from Alaska in the years ending November 15, 1915, 1916, and 1917:

FURS SHIPPED FROM ALASKA IN 1915, 1916, AND 1917.<sup>a</sup>

Species.	Year ended Nov. 15, 1915.			Year ended Nov. 15, 1916.			Year ended Nov. 15, 1917.		
	Number of pelts.	Average value.	Total value.	Number of pelts.	Average value.	Total value.	Number of pelts.	Average value.	Total value.
Bear:									
Black.....	739	\$7.50	\$5,542.50	1,129	\$9.00	\$10,161.00	1,061	\$14.00	\$14,854.00
Brown.....	20	7.50	150.00	41	7.50	307.50	62	12.00	744.00
Glacier.....	3	50.00	150.00	5	50.00	250.00	8	20.00	160.00
Grizzly.....	20	20.00	400.00	14	14.00	196.00	13	17.00	221.00
Polar.....							b 144	40.00	5,760.00
Beaver.....	c 70	10.00	700.00	d 37	6.50	240.50	e 118	10.00	1,180.00
Ermine.....	3,538	.60	2,122.80	4,345	.80	3,476.00	4,639	.90	4,175.10
Fox:									
Black.....	8	400.00	3,200.00	26	250.00	6,500.00	10	160.00	1,600.00
Blue.....	382	50.00	19,100.00	659	50.00	32,950.00	887	58.00	51,446.00
Blue, Pribilof Islands	253	112.49	28,459.97	420	48.20	20,242.00	567	61.11	34,653.50
Cross.....	1,360	12.00	16,320.00	2,508	25.00	62,700.00	2,669	35.00	93,415.00
Red.....	11,770	8.00	94,160.00	15,711	12.00	188,532.00	10,485	24.00	251,640.00
Silver gray.....	187	150.00	28,050.00	318	150.00	47,700.00	443	120.00	53,160.00
White.....	5,967	13.00	77,571.00	6,178	20.00	123,560.00	3,682	28.00	103,096.00
White, Pribilof Islands	40	23.94	957.60	20	14.25	285.00	39	26.33	1,027.00
Hare, Arctic.....	51	.10	5.10	1,090	.15	163.50	89	.40	35.60
Lynx.....	9,374	8.00	74,922.00	21,608	12.00	259,296.00	21,210	14.00	296,940.00
Marten.....	3,028	6.00	18,168.00	3,100	9.00	27,900.00	f 1,210	14.00	16,940.00
Mink.....	23,073	2.00	46,146.00	22,255	4.00	89,020.00	18,832	4.00	75,328.00
Muskkrat.....	32,933	.15	4,939.95	101,827	.35	35,639.45	72,264	.45	32,518.80
Otter:									
Land.....	980	8.00	7,840.00	1,330	15.00	19,950.00	1,308	15.00	19,620.00
Sea.....				g 1	500.00	500.00	h 2	344.85	689.70
Seal, fur, Pribilof Islands	3,000	30.00	90,000.00	7,061	30.00	211,830.00	i 9,140	30.00	274,200.00
Seal, fur.....							j 5	30.00	150.00
Squirrel.....	167	.05	8.35	214	.10	21.40	117	.05	5.85
Wolf.....	51	4.00	204.00	57	7.00	399.00	195	8.00	1,560.00
Wolverine.....	119	7.00	833.00	297	6.00	1,782.00	435	8.00	3,480.00
Total.....			519,950.27			1,143,601.35			1,338,599.55

<sup>a</sup> The corresponding table in the report for 1915, Bureau of Fisheries Document 834, did not include shipments of blue-fox, white-fox, or fur-seal skins from Pribilof Islands.

<sup>b</sup> The killing of polar bears in Alaska is unlawful. Seventeen skins were reported as being taken in extra-territorial waters.

<sup>c</sup> Confiscated pelts.

<sup>d</sup> Thirty-three shipped under permit.

<sup>e</sup> Includes 57 seized skins and 46 reported as Canadian pelts.

<sup>f</sup> Checked against affidavits that skins were taken before Mar. 15, 1916. It is now unlawful to kill martens in Alaska.

<sup>g</sup> Found dead.

<sup>h</sup> Unlawfully killed by natives.

<sup>i</sup> Calendar year 1917.

<sup>j</sup> It is unlawful to kill fur seals within the Territorial waters of Alaska except on the Pribilof Islands.

More reliance must be placed on the cooperation of the shippers themselves in the collecting of statistics of shipments of furs by freight, express, and personal baggage than in the matter of mail shipments. The Bureau avails itself, however, of the opportunity afforded through the courtesy of the collector of customs at Juneau to check its statistics of shipments made otherwise than by mail with those of the customhouse at Juneau.

The statistics of furs shipped from Alaska are compiled annually on the basis of a year extending from November 16 of one year to November 15 of the following year. Most of the furs being taken each season within a period of a few months after November 15, it is thought that summation of the reports for the periods from November 16 of one year to November 15 of the following year will indicate as accurately as possible the take of each season.

### LEASING OF ISLANDS FOR FUR FARMING.

The Department of Commerce may lease for the purpose of propagating foxes and other fur-bearing animals the Alaskan islands listed in the following table:

ISLANDS WHICH MAY BE LEASED FOR FUR FARMING.

Name of island.	Location.
Chirkof.....	Southwest of Kodiak Island.
Long.....	Near Kodiak Island.
Marmot.....	East of Afognak Island.
Little Koniuji.....	Shumagin Group.
Simeonof.....	Do.
Little Naked.....	One of Naked Islands, Prince William Sound.
Carlson (Craiton).....	Prince William Sound.
Middleton.....	Gulf of Alaska.
Pearl.....	One of Chugach Islands.
Elizabeth.....	Do.
Aghiyuk.....	One of Semidi Islands
Chowiet.....	Do.

Of the islands listed above, five were under lease on December 31, 1917, as follows:

Name of island.	Annual rental.	Lessee.
Middleton.....	\$2.00	Joseph Ibach, Cordova, Alaska
Simeonof.....	250	J. C. Smith, Sand Point, Alaska.
Little Koniuji.....	205	Andrew Grosvold, Sand Point, Alaska.
Marmot <sup>a</sup> .....	200	O. L. Grimes, Kodiak, Alaska.
Pearl.....	200	I. D. Nordyke, Seldovia, Alaska.

<sup>a</sup> Lease forfeited in 1918.

*Middleton Island, Gulf of Alaska.*—This island was leased in 1914 to Tim Marcum, of Valdez, for a period of five years, beginning July 1, 1914. The lease was subsequently assigned to Joseph Ibach, present address Cordova, who took possession on June 7, 1915. In December, 1914, and January, 1915, 63 foxes were killed on the island; in December, 1915, and January, 1916, 48 were killed; in December, 1916, and January, 1917, 50 were killed. In the year ended November 15, 1916, 32 live foxes were removed from the island by the lessee.



The foxes on the island run wild, and Mr. Ibach is unable to tell the total number. One year 600 Belgian hares were raised for fox food.

*Simeonof Island, Shumagin Group.*—This island was leased in 1914 to J. C. Smith, of Sand Point, for a period of five years, beginning July 1, 1914. Mr. Smith died July 5, 1917. It is stated that the number of blue-fox pelts, which have been secured on this island in the years from 1901 to 1917, inclusive, is 477.

*Little Koniuji, Shumagin Group.*—This island was leased in 1914 to Andrew Grosvold, of Sand Point, for a period of five years, beginning July 1, 1914. Mr. Grosvold has reported that on November 15, 1917, there were 37 pairs of foxes on the island.

Litigation has been carried on for a number of years between F. E. Whelpley and Andrew Grosvold in respect to the latter's rights on Little Koniuji Island. Foxing operations having been undertaken on the island by Mr. Whelpley before Mr. Grosvold secured a lease of it from the Department of Commerce, suit was instituted by Mr. Whelpley contesting Mr. Grosvold's rights. On August 2, 1916, Judge Brown, of the District Court of Alaska, in session at Valdez, decided adversely to Mr. Whelpley. The case was taken by him to the Circuit Court of Appeals at San Francisco. The decision of that court on April 1, 1918, affirmed the action of the lower court.

*Marmot Island.*—This island is situated near Afognak Island and was leased in 1916 to O. L. Grimes, of Kodiak, for a period of five years, beginning September 1, 1916. Under date of February 2, 1918, Mr. Grimes advised that he had forfeited the lease.

*Pearl Island, Chugach Group.*—This island was leased in 1917 to I. D. Nordyke, of Seldovia, for a period of five years, beginning July 1, 1917.

## FUR-SEAL INDUSTRY.

### PRIBILOF ISLANDS.

#### GENERAL ADMINISTRATIVE WORK.

In addition to various lines of work which are more or less routine in character from year to year the Bureau devoted considerable attention in 1917 to the subject of the utilization of products of the Pribilof Islands not heretofore used to any considerable extent. A part of the Bureau's efforts looking toward the exploitation of previously unused products culminated successfully while other lines of effort were being continued at the end of the calendar year. For the first time the Bureau was able to use one of its own vessels for the carrying of general cargo to and from the islands. Increased appropriations by Congress permitted sending to the islands materials for several new buildings, for repairing others, and for improving the water-supply system for the village on St. George Island. A census of the seal herds was again taken. The more important activities are taken up in detail under appropriate headings.

#### PERSONNEL.

The statutory employees of the Bureau on the Pribilof Islands in 1917 are listed in the introduction. As a matter of record the following information in regard to their activities and in regard to certain temporary employees is given:

Agent and Caretaker Proctor, of St. George Island, arrived there from the States on June 7, relieving G. Dallas Hanna, who had been in charge of the Bureau's work on the island since the previous October. Agent and Caretaker Fassett left St. Paul Island temporarily in December, leaving Mr. Hanna in general charge of the work there. Dr. W. Byrd Hunter, formerly physician on St. Paul Island, having reentered the Bureau's service, arrived at St. Paul Island July 23 to resume his duties as physician. Dr. Miles, who was relieved by Dr. Hunter, was transferred to St. George Island, relieving Dr. H. P. Adams, who left St. George for the States August 2. Mr. Hanna was in general charge of the fur-seal census. He was assisted by other members of the Bureau's regular force and by Dr. Harold Heath, of Stanford University. Mrs. G. Dallas Hanna had charge of the junior school on St. George Island during the school year 1916-17. Mrs. A. H. Proctor took charge of this school for the school year 1917-18. Mrs. W. Byrd Hunter was employed as a nurse on St. Paul Island beginning August 1. Warden Charles E. Crompton, having been detailed for duty at the Pribilofs, reported at St. Paul Island on June 8. Arnold C. Reynolds was relieved temporarily of his duties as school-teacher on St. George Island on October 15, his work being taken up by Mr. Crompton. Mr. Reynolds left for the States December 15. Warden H. C. Scudder, who reported at St. Paul Island for duty in September, 1916, left there July 31, 1917, for Seattle.

## PURCHASE AND TRANSPORTATION OF SUPPLIES.

Food, fuel, and clothing for the natives, supplies for the general use of the Bureau's stations, materials for repairs and construction of buildings, and salt and barrels for preserving and packing seal-skins were for the most part forwarded to the islands from Seattle.

Practically all the supplies purchased in 1917 for the Pribilofs were secured from dealers who had made the most favorable terms in response to the Bureau's requests for competitive bids. As in previous years, the major portion of the Bureau's requirements for the season of 1917 were described in a series of appropriate schedules which were printed in pamphlet form and distributed among prospective bidders. Owing to the disturbed conditions which obtained in 1917, many substitutions had to be made for the commodities regularly used in the past and unusual difficulty was experienced in obtaining satisfactory bids.

About 300 tons of supplies which had been held in Seattle since the preceding fall, because facilities were not available for their transportation, were placed aboard the U. S. S. *Saturn* on May 20 and delivered in due time at the Pribilof Islands. The Bureau is under obligations to the Department of the Navy for the assistance furnished by the *Saturn*.

Through the courtesy of the Coast Guard the cutter *Unalga*, which left Seattle on May 3, carried a considerable quantity of supplies for the Pribilofs. The Bureau's supplies, together with some for the St. Paul radio station, totaled probably 50 tons by measurement. The vessel reached the Pribilofs with the supplies early in June.

The Bureau's steamer *Roosevelt* left Seattle on July 7 with a cargo of approximately 275 tons of supplies for the Pribilofs. Minor additional supplies were taken aboard at Unalaska. The shipment consisted in part of materials for six houses to be constructed for the use of natives and for the improvement of the village water supply on St. George Island. The vessel arrived at St. George Island July 21.

The *Roosevelt* left Seattle with a second cargo of supplies, consisting chiefly of foodstuffs and clothing, on September 7. An accident to the vessel's machinery caused the master to deem it advisable for the vessel to return to Seattle for repairs. The ship again left Seattle on October 23, arriving at St. George Island on November 13.

*Landing supplies at Pribilofs.*—It seems strange that under modern conditions no substitute which would be recognized without question as being superior to the primitive native boat, the bidarra, for lightening supplies ashore at the Pribilof Islands has been obtained. However, the bidarra is by no means an ineffective contrivance. In discharging cargo at St. George in 1917 several loads of 8½ tons dead-weight each were carried, but such loadings can only be carried when little or no swell is running.

The use of canvas in place of sea-lion skins as covers for bidarras was tried in an experimental way on one at St. George Island in 1916. In order to protect the canvas from rocks, chafing strips of half-round oak were placed on this bidarra in 1917. The strips accomplished all that was expected of them. The agent in charge at St. George believes that the canvas-covered bidarra will prove as useful as those covered with sea-lion skins and that less labor will be required to keep it in repair.

As between the use of canvas or sea-lion skins as covers for bidarras, each material has some advantage over the other. With the great diminution in the supply of sea lions, the finding of some substitute for sea-lion skins seemed imperative. Sea-lion skins will withstand without puncture greater blows against jagged rocks than will canvas, and for this reason may be looked upon as being to some extent safer.

#### NEW BUILDINGS AND REPAIR WORK.

The act of Congress making appropriations for sundry civil expenses of the Government for the fiscal year 1917, and for other purposes, contained an item providing \$20,000 for new buildings and other improvements at the Pribilof Islands. The appropriation became available too late to permit the purchase and shipment of supplies to the islands in the calendar year 1916.

It was decided that a number of new buildings, including houses for the natives and salt houses for use in salting and storing seal-skins, repairs to existing buildings, and improvements to the water-supply systems for the villages were the most urgent requirements.

Six houses of the "knock-down" type were purchased and sent to the islands in 1917, four to St. Paul and two to St. George. The plans provided that each house should have a kitchen, living room, bathroom, and three bedrooms, all on one floor. It was provided also that the roof of each should be sufficiently high to permit the construction of two additional rooms on a second floor at small cost, although it was thought that the accommodations on the first floor would be sufficient for any of the large families on the islands. The agent on St. Paul Island, however, made modifications in the plans furnished him with the result that additional material will be required to complete the construction of four houses. On St. George other work interfered with beginning the erection of the two houses for that island until so late in the season that it was deemed advisable to postpone their construction until the spring of 1918.

In 1917 there were also shipped to the islands the major part of the materials for two salt houses, one for St. Paul and one for St. George, and for the proposed new water-supply system for St. George Island, as well as miscellaneous supplies for repairing already existing buildings. It is proposed to send the balance of the materials, including the supplies for the water-supply system on St. Paul Island, in 1918.

#### USE OF STEAMER "ROOSEVELT."

Previous to 1917 the Bureau in securing the transportation of persons and supplies to and from the Pribilofs had to depend upon courtesies afforded by other departments and upon private vessels hired or chartered. In 1917 the Bureau was able to make use of a vessel of its own, the *Roosevelt*, for the major part of the year's work. The Bureau was particularly fortunate in not being obliged to secure a privately-owned vessel, when the demand for shipping was so keen.

The *Roosevelt* arrived at Seattle on April 23, 1917, completing her voyage from the Atlantic seaboard. The principal use made of the vessel for the remainder of the year was the transportation of supplies and employees between Seattle and the Pribilofs. Two trips were made from Seattle to the islands.

On the first trip the vessel left Seattle July 7 and arrived at St. George Island July 21, having touched en route at Ketchikan, Akutan, and Unalaska. After discharging a part of the St. George cargo the vessel left for St. Paul Island on July 22, arriving there on the 23d. The work of discharging cargo, taking aboard sealskins, fox skins, bones, and other products of the islands for delivery at Seattle, and affording transportation to employees between St. Paul and St. George Islands, occupied the time until August 1, when the *Roosevelt* left for Seattle. The vessel stopped at Akutan, Ketchikan, and Prince Rupert on the way and Seattle was reached on August 18. An accident which occurred to the machinery soon after the vessel left Akutan caused some delay and a reduction in speed for the balance of the trip to Seattle.

The *Roosevelt* left Seattle with another cargo of supplies September 7 and arrived at Ketchikan September 11. An accident having occurred to the machinery the vessel returned to Seattle for repairs. A start was again made from Seattle October 23 and the Pribilofs were reached November 13, stops having been made en route at Ketchikan, Akutan, and Unalaska. Before returning to Seattle the *Roosevelt* made a trip from the islands to Unalaska for a supply of coal, 265 tons, which it delivered at the islands. The vessel finally left the Pribilofs on December 17, 1917, and arrived at Seattle on January 14, 1918. Stops were made en route at Unalaska, Akutan, Sand Point, Cold Bay, Cordova, and Ketchikan. When the vessel left the islands on December 17, there was taken along, at the request of the officer in charge of the St. Paul radio station, a man who had been employed as cook at that station but who had become insane. The man later became so violent that he was turned over to the civil authorities at Unalaska, facilities for caring for him aboard the *Roosevelt* being inadequate.

#### NATIVES OF THE PRIBILOF ISLANDS.

The Bureau is developing ways and means whereby the natives of the Pribilofs may be enabled to support themselves and to secure benefits for themselves individually over and above the bare necessities of life in proportion as they are industrious, economical, and thrifty. They now receive \$5 in cash for each fox skin taken for the Government, and arrangements have been made whereby they receive payment for seal and other bones gathered for sale. It is probable that when definite plans are made for commercial sealing operations in 1918 some arrangement will be had whereby the natives will receive compensation in money for their sealing work in proportion to the number of properly taken skins.

#### HEALTH.

Physicians were maintained on both St. Paul and St. George Islands throughout the year.

As the result of suggestions made by the resident physician on St. Paul Island, Dr. W. Byrd Hunter, the following instructions were issued September 11, 1917, for both islands.

(a) The physician shall have direct charge of all matters pertaining to health and sanitation on the island. This, however, is not to be independent of the general authority of the agent in charge, as divided control in administrative matters is re-

garded as prejudicial to the interests of the Bureau and without compensating benefit.

(b) The physician shall keep an accurate record of all cases treated, giving name of patient, diagnosis, treatment, and results. He shall also make periodical physical examinations of all natives and record findings on health cards kept in the dispensary for this purpose. These records shall be open to inspection by proper persons.

(c) The physician shall report daily to the agent in charge the names of workmen who are totally disabled, those partially disabled, and those detained at home on account of sickness in the family. These men shall not be called upon for work unless approved by the physician.

(d) The physician shall report monthly to the agent in charge all medical and surgical cases treated during the month, giving the results of treatment; number of births, giving name, sex, and date of birth; number of deaths, giving name, age, sex, and cause of death; and other pertinent information. The forms of blanks submitted by the agent under date of December 5, 1916, for birth certificates, death certificates, reports of surgical operations, and christening certificates are approved by the Bureau and will be used until otherwise directed. Copies are to be furnished to the Bureau.

(e) The physician shall report at least annually to the Commissioner of Fisheries all medical, surgical, sanitary, or other work done during the year or period covered by such report, offering any recommendations for health improvement he may deem necessary. This report shall begin when the last preceding report ended, so that there will be no period of time not covered by a report. The original and two copies of each report shall be delivered to the agent in charge, who will forward the original to the Commissioner of Fisheries with such comments as he deems proper, retain one copy for the official files of the island, and forward one copy to the agent in charge of St. George Island for the information of the physician on that island. A copy shall also be retained in the files of the dispensary on St. Paul Island.

(f) The physician is authorized to condemn supplies of foodstuffs when he knows beyond any reasonable doubt that they are unfit for human or other consumption.

(g) The physician shall make weekly inspections of all houses in the village and the surrounding grounds and report to the agent in charge any person breaking the health regulations.

(h) From time to time the physician will make necessary inspections of the live stock.

(i) Owing to the nature of the physician's work and the likelihood of his being called at any time, day or night, he will not be required to do any station work other than his regular duties unless the circumstances are unusual or of an emergency nature. The physician will no doubt at times be glad to assist in some phases of the work not directly connected with his duties.

*St. Paul Island.*—In October an epidemic of influenza assumed such proportions that the vigor of the natives was materially impaired and fall sealing operations were noticeably affected.

The use of the hospital on St. Paul has been continued to advantage. The Bureau was fortunate in being able to arrange for the cooperation and services of a trained nurse, the wife of the resident physician.

It was reported that the new priest for the native congregation had shown a willingness to cooperate in an educational way in lessening insanitary church customs.

*St. George Island.*—In March, 1917, there broke out on this island an epidemic reported by the physician as varicella. The epidemic reached its height in April and continued into May. There were about 48 cases, and all occurred in children under 10 years of age. The physician called attention to the long lapse of time between the arrival of the last steamer, which reached the island November 3, 1916, and the commencing of the epidemic, March 21, 1917, a period of four and one-half months. Later in the year there was an epidemic of influenza, said to have been introduced from Unalaska. There were a number of mild cases, a few serious ones, and one death resulted.

## SCHOOLS.

The Bureau recognizes the value of employing proper educational methods on the islands and is endeavoring to make its system of instruction increasingly effective in developing the character of the children. The responsibility resting upon those who are employed as teachers can not be too strongly emphasized, and, on the other hand, it is equally important that they be furnished with facilities and in other ways afforded the fullest possible opportunities for performing their duties.

*St. Paul Island.*—The 1916-17 school year began September 12, 1916, and ended June 1, 1917. Two regular teachers are employed on this island, and senior and junior schools are maintained. At the opening of the schools on September 12, 1916, the combined enrollment of pupils numbered about 64.

The following extracts are taken from the joint report submitted by the teachers for the year 1916-17:

As in the two preceding years, there has been a preparatory class for children before they begin regular first-grade work. These are children 4 and 5 years of age. There have been 11 pupils in this class. The attendance has been very irregular. This was due partly to the severity of the weather during the winter. There has been some training of hand and eye, the phonetic value of the alphabet has been taught, but no attempt has been made to teach these children to read. The greater part of the period devoted to this class (2 p. m.-3 p. m.) has been used in giving the children an English vocabulary.

The junior school building is a pleasant and well-lighted room, but it is altogether too small; the floor space is so limited that it does not admit of activities or games for the little ones.

The work in arithmetic has been arranged in grades. Concrete examples have been found necessary; blocks, sheets of paper, pencils, and other objects have been in constant use. Fractions were taught by means of cardboard circles cut into equal parts. Some of the pupils soon discarded this method and were able to think in the abstract, but many can never get beyond the "finger stage" in arithmetic. The number sense is developed in practically all children at a later age than other concepts. This is particularly true of the Aleut child. This sense is dormant until nearly the tenth year with the average, but it must be admitted that there is difficulty in speaking of the average child, for some are extremely dull and apathetic, while others would compare favorably with children in the States.

Geography with the younger ones began "at home." The pupils know their own island so well, from having visited all parts, that when the map of St. Paul is placed before them they are able to identify capes, small islands, straits, peninsulas, etc. This has led on to outline maps of North America and South America, dwelling particularly on the United States. Globe work has been coordinated continually with other map studies. Localities mentioned in the reading lessons have been pointed out at the time of reading. The pupils take an interest in the staple products brought to the islands and wish to know where "they grow" and what they "grow on," thus touching on nature study in its practical phases. With the older pupils a correlation of history with geography has been worked out in a simple manner. Reading, conversation, and composition and spelling on the same subject have been the chief studies, since nothing can be done with other textbooks unless the knowledge of the reading and conversation is sufficient.

A test of the conversational power of the pupils in English was made in the senior school. For a week all pupils were allowed to communicate with each other, with the condition that no Aleut word should be used. Of course during recitations general talking was not allowed. About 70 per cent were able to communicate all their wants and wishes to each other and to make comments on readings. It has been observed that occasionally outside school hours the children have chosen to use only English in playing some games.

About 50 books which were to be discarded were presented to the schools by the Seattle Public Library. As there was almost nothing in the way of a school library, and as these books were especially suited to younger children, they have been in constant demand and have been greatly appreciated. "The Youth's Companion," "The American Boy," and "St. Nicholas," which have been supplied to the school

are too difficult for most of the children to read, but the pictures have been enjoyed and have led to many inquiries. Both the books and magazines have been loaned to young people out of school, who have read them eagerly.

At Christmas time a public entertainment was given by the two schools, in which every child took part. All the parents were invited, and a large number attended and seemed interested in the way the children took their parts.

During March, April, and May all the older girls had a sewing lesson once a week. Almost all the native women crochet very well, but only a few of them sew well. Crocheted doilies and lace are found in every house, but buttonholes are seldom made (safety pins are substituted), and a torn garment never is mended. The sewing has been taught with the hope that a practical use may be made of it. It is recommended that material be furnished the school, and that not only sewing, but also knitting and darning lessons, be a part of the regular course for all the girls. Sometimes children who are slightly deficient mentally can do creditable work with the hands.

The older pupils have been excused from school several times during the school sessions to engage in various kinds of work on the island. During the latter part of the school year they did efficient work in gathering refuse and in general cleaning around the buildings of the village.

The reports which have come from the boys at Chemawa are good. These boys seem to be doing satisfactory work and to be contented. In regard to industrial work, it is suggested that more of the boys who go to Chemawa take up various branches of elementary mechanical work, such as blacksmithing, plumbing, and care of simple gasoline motors, etc., a line of work much needed on these islands.

In commenting on this report the Bureau approves the recommendation that instruction in needlework and knitting be made a part of the regular curriculum for the girls. Arrangements have been made to provide necessary materials.

*St. George Island.*—A senior and a junior school are maintained on this island. The senior school includes in general all the children between the ages of 6 and 16 years of age. The junior school is conducted principally for preparing the younger children, those under the regular school age of 6 years, for entrance into the larger school.

The senior school for the session of 1916-17 opened September 5, 1916, and closed April 27, 1917. Thirty-three pupils were in attendance, 15 boys and 18 girls. In giving instruction object lessons and concrete examples were used wherever practicable. In language work emphasis was placed upon the use of English, which, strange as it may seem, is not the habitual language of the children, although schools have been maintained at the Pribilofs under the supervision of the Government for nearly 50 years. Some of the older pupils are beginning to read the simpler stories in magazines. In arithmetic stress is placed upon practical problems. Attention was given to writing, geography, history, and spelling.

One of the classes studied a number of chapters of "Good Health," by Frances Gulick Jewett. This book is written in a form suitable for Pribilof children. An epidemic of chicken pox, which occurred on St. George Island in the year, was utilized to advantage in the way of furnishing subject matter for instruction in health problems, and the teacher's knowledge of bacteriology was also of use to him in imparting elementary information. Efforts were made to improve the moral and physical condition of the pupils, and physical-culture drills were given each morning.

The junior school was opened on October 1, 1916, and closed May 31, 1917. Nine children were in attendance. The report of the work in this school, submitted by the teacher in charge of it, indicated that considerable ingenuity had been exercised in devising methods for interesting the small children.



The senior school reopened for the school year 1917-18 on October 8, 1917, with an attendance of 33 pupils, 15 boys and 18 girls; the junior school on September 4, 1917, with an attendance of 8 pupils, 5 boys and 3 girls.

*Library books.*—About 400 books were forwarded to the islands for general use, these having been obtained for that purpose from the Library of Congress by the Bureau's librarian. The books were divided between St. Paul and St. George Islands. The agent in charge of St. George Island reported that a large portion of the books received by him seemed to be particularly fitted for use in the school and that a selection would be made to form the nucleus of a school library. Mention is also made of the presentation of about 50 books to the St. Paul schools by the Seattle Public Library. These books were especially suited to younger children. The teachers on St. Paul Island state that they have been in constant demand and have been greatly appreciated.

*Attendance at Salem Indian Training School.*—The Bureau encourages the attendance of children of the Pribilofs at the Salem Indian Training School at Chemawa, Oreg. On December 31, 1917, there were in attendance at this school from St. Paul Island the following: Ioaniky Emanoff, Agrafina Fratis, Julia (Ouliana) Fratis, Martha Fratis, Peter T. Kochergin, Alfey Melovidov, Terenty Merculieff, and Daniel Shabalín. George Lekanof, of St. George Island, was also in attendance at the school on December 31. Alexey Emanoff, of St. Paul Island, who entered the school in October, 1915, and subsequently, on account of his health, left for the school at the Fort Lapwai Sanitarium, Lapwai, Idaho, was still at the sanitarium on December 31. Constantine Lestenkof, of St. George Island, who entered the school in August, 1914, returned home in 1917. Children who attend the school at Chemawa do not always return to the Pribilofs to live.

It has been stated that the children from the Pribilof Islands are noticeably among the very best coming to the school from any place, that they give less trouble than any other group of children, and that their progress is very satisfactory.

#### MOTION PICTURES.

In 1916 the Bureau sent to St. Paul Island 100,000 feet of motion-picture films. The material was supplied chiefly for the purpose of affording instruction and recreation to the natives. Employees of the radio station on the island agreed to supply a machine for showing the pictures. The natives received the entertainments provided most enthusiastically. Comedy, news, and educational subjects appeared to be the most appreciated. Owing to the undoubted value of this form of entertainment, another supply of films was sent to St. Paul in 1917. The Bureau rents the pictures for the winter season or until such time as they can be returned in the following spring or summer.

#### SAVINGS ACCOUNTS.

A number of the natives of the Pribilofs have personal funds which have been placed by them in the custody of the United States Commissioner of Fisheries as trustee. Throughout the year 1917 these

funds were kept on deposit with the Washington Loan & Trust Co., Washington, D. C. Each native whose funds are concerned has the privilege of securing any portion of his share at any time upon request.

The funds on deposit draw interest at the rate of 3 per cent per annum, which is calculated on monthly balances. Interest is credited semiannually. The Commissioner's records of the funds are subject to an auditing every six months by the disbursing clerk for the Department.

On January 1, 1917, the total amount of the funds, including interest, \$70.78, credited on that date was \$4,729.36. Funds of Polyxenia Merculiof, of St. George Island, amounting to \$107.41, were deposited March 8, 1917. Interest credited July 1, 1917, amounted to \$68.52. Withdrawals during the year amounted to \$516.67. The balance on December 31, 1917, including interest, \$66.36, credited on that date was \$4,454.98.

PRIBILOF ISLANDS NATIVES' SAVINGS ACCOUNTS IN THE CUSTODY OF THE UNITED STATES COMMISSIONER OF FISHERIES, AS TRUSTEE, DEC. 31, 1917.

Funds of—	Amount.	Funds of—	Amount.
St. Paul Island:		St. Paul Island—Continued.	
Bourdukofsky, Apollon.....	\$205.64	Merculieff, Paul A.....	\$13.86
Bourdukofsky, Peter.....	137.33	Merculieff, Terenty.....	35.39
Diakanof, Auxenia (Mrs. C. H. Hope) <sup>a</sup> .....	23.56	Oustigoff, Peter.....	71.65
Emanoff, Alexey <sup>a</sup> .....	270.41	Pankoff, Agrippina.....	314.48
Fratiss, Agrifina <sup>a</sup> .....	85.00	Pankoff, Maria M.....	39.46
Fratiss, Akalina <sup>a</sup> .....	500.93	Rukovishnikoff, Elisaveta.....	13.49
Fratiss, Martha <sup>a</sup> .....	84.98	Sedick, Marina.....	15.53
Fratiss, Ouliana <sup>a</sup> .....	84.98	Tetoff, Vikenty M.....	39.45
Gromoff, Iuliana.....	868.53	St. George Island:	
Hanson, John.....	46.58	Galanin, Mary.....	264.26
Kozloff, Parascovia.....	179.60	Lestenkof, Michael.....	206.65
Krukoff, Iuleta.....	108.89	Merculiof, Agrifina.....	113.18
Mandregan, Alexandra M. <sup>b</sup> .....	39.46	Merculiof, Joseph.....	71.77
Melovidov, Alfey.....	39.46	Merculiof, Polyxenia.....	109.83
Melovidov, Anton.....	3.40	Philomonof, Mary <sup>c</sup> .....	108.49
Melovidov, Iosef.....	39.46	Philomonof, Zoya.....	107.35
Merculieff, Dosofey.....	35.39	Shane, Michael.....	76.55
Merculieff, Makary.....	35.39	Zacharof, Emanuel.....	29.21
Merculieff, Mariamna.....	35.39	Total.....	4,454.98

<sup>a</sup> Not living on islands in 1917.

<sup>b</sup> Formerly Alexandra Melovidov.

<sup>c</sup> Deceased, estate undivided.

CENSUS.

In order to make certain facts in regard to the inhabitants of the Pribilof Islands a matter of official record an annual census is taken of the natives on each island. The census in 1917 was taken as of March 31 and the more salient details follow:

## NATIVES RESIDENT ON ST. PAUL ISLAND, ALASKA, MAR. 31, 1917.

Names of individuals (grouped by families).	Age last birth- day.	Birthplace.	Names of individuals (grouped by families).	Age last birth- day.	Birthplace.
Balakshin, Matrona..	68	St. Paul Island.	Kozhevnikoff, Paul...	34	St. Paul Island.
Bourdukofsky, Apol- lon.	63	Unalaska, Alaska.	Kozhevnikoff, Maria..	42	St. George Island.
Bourdukofsky, Peter.	37	St. Paul Island.	Kozhevnikoff, Evdo- kia.	8	St. Paul Island.
Bourdukofsky, Alex- andra.	25	Marjovi, Alaska.	Kozloff, Michael.....	31	Do.
Bourdukofsky, Helen S.	11	St. Paul Island.	Kozloff, Iustinia.....	41	Kiska Island, Alaska.
Bourdukofsky, Mar- tha.	5	Do.	Kozloff, Olga.....	3	St. Paul Island.
Buterin, Constantine.	30	Do.	Kozloff, Raisa.....	1	Do.
Buterin, Marina.....	26	St. George Island.	Kozloff, Nicolai.....	29	Do.
Buterin, Alexandra...	4	St. Paul Island.	Kozloff, Olga.....	26	Holy Cross Mission, Alaska.
Buterin, Karp.....	65	Do.	Kozloff, Parascovia...	58	Unalaska, Alaska.
Buterin, Parascovia...	62	Unalaska, Alaska.	Krukoff, Condrat.....	27	St. Paul Island.
Buterin, Iuliana E....	8	St. Paul Island.	Krukoff, Vassa.....	22	Do.
Buterin, Maxim K....	4	Do.	Krukoff, Daniel.....	2	Do.
Emanoff, Mary.....	42	Atka, Alaska.	Krukoff, Samuel.....	(a)	Do.
Emanoff, Mamant....	10	St. Paul Island.	Krukoff, Ekaterina...	58	Kamchatka, Siberia.
Emanoff, Maxim.....	5	Do.	Krukoff, John.....	36	St. Paul Island.
Emanoff, Peter.....	13	Do.	Krukoff, Iuleta.....	32	Do.
Fratis, John.....	30	Do.	Krukoff, Alexandra...	10	Do.
Fratis, Snandulia....	26	Do.	Krukoff, Kleopatra...	6	Do.
Fratis, Anfesa.....	(a)	Do.	Krukoff, Tatiana.....	8	Do.
Fratis, Anton.....	4	Do.	Krukoff, Metrcfan...	33	Do.
Fratis, David.....	6	Do.	Krukoff, Pelagia.....	29	St. George Island.
Galaktionoff, Lukia..	40	Do.	Krukoff, Maifev.....	7	St. Paul Island.
Galaktionoff, Aggey..	10	Do.	Krukoff, Paul.....	2	Do.
Galaktionoff, Elena...	7	Do.	Kushin, Elena.....	24	Marjovi, Alaska.
Galaktionoff, Maria...	14	Do.	Kushin, John H.....	2	St. Paul Island.
Galaktionoff, Matrona	13	Do.	Kushin, Michael.....	32	Do.
Gromoff, Iuliana.....	48	Do.	Kushin, Matrona....	25	Do.
Gromoff, Elary S....	15	Do.	Kushin, Anton F....	(a)	Do.
Hanson, Anna.....	16	Do.	Kushin, Glekeria....	4	Do.
Hanson, John.....	20	Do.	Mandregan, Inno- kenty.	26	Do.
Hanson, Chionia.....	21	Do.	Mandregan, Maria...	19	Do.
Hapoff, Nekita.....	28	Do.	Mandregan, Agafia...	1	Do.
Hapoff, Parascovia...	28	Do.	Mandregan, Nekifer..	21	Do.
Hapoff, John.....	8	Do.	Melovidov, Anton...	23	Do.
Hapoff, Platonida...	6	Do.	Melovidov, Alexandra	21	Do.
Hapoff, Valentina...	2	Do.	Melovidov, Solomon	41	Do.
Kochergin, Gregory..	39	Do.	Melovidov, Alexandra	15	Do.
Kochergin, Agafia...	38	Do.	Melovidov, Alfey....	13	Do.
Kochergin, Gavriel S.	5	Do.	Melovidov, Iosef....	10	Do.
Kochutin, Jacob.....	65	Do.	Merculieff, Agafia...	38	Do.
Kochutin, Alexandra.	53	Unalaska, Alaska.	Merculieff, Dosofey...	12	Do.
Kochutin, John.....	46	St. Paul Island.	Merculieff, Makary...	8	Do.
Kochutin, Klavdia...	36	St. George Island.	Merculieff, Mariamna	6	Do.
Kochutin, Erena.....	13	St. Paul Island.	Merculieff, Terenty...	13	Do.
Kochutin, Simeon...	5	Do.	Merculieff, John.....	33	Do.
Kochutin, Theodore...	28	Do.	Merculieff, Evdokia...	46	St. Michael, Alaska
Kochutin, Maria.....	30	Do.	Merculieff, Leonty...	9	St. Paul Island.
Kochutin, Anna.....	2	Do.	Merculieff, Serafima...	12	Do.
Kochutin, Augusta...	5	Do.	Merculieff, Paul.....	27	Do.
Kochutin, Jacob.....	(a)	Do.	Merculieff, Maria...	24	Umnak Island, Alaska.
Kochutin, Karp.....	11	Do.	Merculieff, Abraham S.	2	St. Paul Island.
Kochutin, Nekifer...	4	Do.	Merculieff, Paul A....	22	Do.
Kochutin, Prascodia.	8	Do.	Misikin, John.....	27	Do.
Kochutin, Zenovia...	48	Do.	Misikin, Natalia.....	30	Unalaska, Alaska.
Kochutin, Innokenty.	14	Do.	Misikin, Anna.....	7	St. Paul Island.
Kozerooff, Uvanaly...	28	Do.	Misikin, Victor.....	8	Do.
Kozerooff, Fekla...	22	St. George Island.			
Kozerooff, Alexandra.	2	St. Paul Island.			
Kozerooff, Vassa.....	(a)	Do.			

a Infant.

## NATIVES RESIDENT ON ST. PAUL ISLAND, ALASKA, MAR. 31, 1917—Continued.

Names of individuals (grouped by families).	Age last birth- day.	Birthplace.	Names of individuals (grouped by families).	Age last birth- day.	Birthplace.
Nozekoff, Simeon.....	40	Unalaska, Alaska.	Shaposhnikoff, Para- scovia.	50	St. Paul Island.
Nozekoff, Haretina R.	9	St. Paul Island.			
Nozekoff, Maria.....	19	Do.	Stepetin, Dorofey.....	46	Do.
Nozekoff, John T.....	12	Do.	Stepetin, Lubov.....	37	Do.
Oustigoff, Neil.....	26	Do.	Stepetin, Epaty.....	7	Do.
Oustigoff, Mary.....	21	Do.	Stepetin, Kapetolina.	4	Do.
			Stepetin, Xenia.....	18	Do.
Oustigoff, Peter.....	52	St. George Island.			
Oustigoff, Flena.....	43	St. Paul Island.	Stepetin, Flary.....	53	Do.
Oustigoff, Andronik..	1	Do.	Stepetin, Anna.....	38	Unalaska, Alaska.
Oustigoff, Dmitri.....	12	Unalaska, Alaska.	Stepetin, Andrey.....	3	St. Paul Island.
Oustigoff, Parascovia.	8	St. Paul Island.	Stepetin, Nicolai.....	13	Do.
			Stepetin, Peter.....	8	Do.
Pankoff, Porfiry.....	55	Do.			
Pankoff, Varvara.....	35	Attu Island, Alaska.	Stepetin, John.....	37	Do.
Pankoff, Maria M.....	7	St. Paul Island.	Stepetin, Vera.....	36	Do.
			Stepetin, Alexandra..	6	Do.
Pankoff, Vlass.....	29	Do.	Stepetin, Elarion.....	12	Do.
Pankoff, Agrippina....	28	Do.	Stepetin, Evdokia.....	8	Do.
			Stepetin, Olga.....	10	Do.
Rukovishnikoff, Ste- fan.	36	Do.	Stepetin, Vasilii.....	15	Do.
Rukovishnikoff, Eli- saveta.	29	Do.	Stepetin, Vasilii.....	24	Do.
Rukovishnikoff, And- rey.	11	Do.	Stepetin, Mavra.....	18	Do.
Rukovishnikoff, Elo- knida B.	1	Do.	Stepetin, Auxenty.....	9	Do.
Rukovishnikoff, Geo.	4	Do.			
Rukovishnikoff, Iro- senia.	(a)	Do.	Tetoff, Neon.....	47	Do.
Rukovishnikoff, Marfa	7	Do.	Tetoff, Agrippina.....	41	Unalaska, Alaska.
			Tetoff, Agnia.....	3	St. Paul Island.
			Tetoff, Agrippina.....	14	Do.
			Tetoff, Anna.....	10	Do.
			Tetoff, Dmitri.....	19	Do.
			Tetoff, Ekaterina.....	(a)	Do.
Sedick, Feodosy.....	73	Do.	Tetoff, Ercha.....	17	Do.
			Tetoff, Sosepatra.....	5	Do.
Sedick, Innokenty....	32	Do.			
Sedick, Ripsimia.....	24	Do.	Tetoff, Peter.....	52	Do.
Sedick, Feofania.....	6	Do.	Tetoff, Maria.....	55	St. George Island.
Sedick, Lavrenty.....	1	Do.	Tetoff, Vikenty M.....	6	St. Paul Island.
Sedick, Leonty.....	3	Do.			
			Tetoff, Zachar.....	37	Do.
Sedick, John.....	19	Do.	Tetoff, Daria.....	36	St. George Island.
Sedick, Marina.....	18	Do.	Tetoff, Feodosia.....	3	St. Paul Island.
Shabalin, Daniel.....	14	Do.	Tetoff, Paul.....	11	Do.
Shabalin, Matrona....	16	Do.	Tetoff, Tatiana.....	1	Do.
			Tetoff, Venedict.....	10	Do.
Shaishnikoff, George..	34	Do.			
Shaishnikoff, Evdokia	26	Unalaska, Alaska.	Vikaloff, Alexander...	19	Do.
Shaishnikoff, Serge...	11	St. Paul Island.			

## NATIVES RESIDENT ON ST. GEORGE ISLAND, ALASKA, MAR. 31, 1917.

Names of individuals (grouped by families).	Age last birth- day.	Birthplace.	Names of individuals (grouped by families).	Age last birth- day.	Birthplace.
Galanin, Alexander...	31	St. George Island.	Kashevarof, Peter....	60	Kodiak, Alaska.
Galanin, Mary.....	25	St. Paul Island.	Kashevarof, Anna.....	52	Do.
Galanin, Katherine....	7	St. George Island.	Pavlof, Katherine.....	23	Belkofsky, Alaska.
Galanin, Helena.....	5	Do.	Philomonof, Helena...	12	St. George Island.
Galanin, Moses.....	3	Do.			
Galanin, John.....	35	Do.	Kashevarof, Walter...	29	Belkofsky, Alaska.
Galanin, Anna.....	35	St. Paul Island.	Kashevarof, Helena...	32	St. George Island.
Galanin, Gabriel.....	7	St. George Island.	Kashevarof, Andrew...	9	Do.
Galanin, Raphael.....	3	Do.	Kashevarof, Nina.....	8	Do.
Galanin, Xenephont...	2	Do.	Kashevarof, Laurence	6	Do.
Galanin, Augusta.....	(a)	Do.	Kashevarof, Valen- tine.	4	Do.
Galanin, Akalma.....	54	St. Paul Island.	Kashevarof, Peter....	3	Do.

• Infant.

## NATIVES RESIDENT ON ST. GEORGE ISLAND, ALASKA, MAR. 31, 1917—Continued.

Names of individuals (grouped by families).	Age last birth- day.	Birthplace.	Names of individuals (grouped by families).	Age last birth- day.	Birthplace.
Lekanof, Anatole.....	26	St. George Island.	Mercuriof, Stepan.....	26	Do.
Lekanof, Agnes.....	22	St. Paul Island.	Mercuriof, Agrafina...	19	St. Paul Island.
Lekanof, Alexandra...	5	St. George Island.	Mercuriof, Natalia.....	2	St. George Island.
Lekanof, Laurence....	1	Do.	Mercuriof, Nadesda...	(a)	Do.
Lekanof, Stepan.....	47	Unalaska, Alaska.	Mercuriof, Alexandra..	38	Do.
Lekanof, Pelegia.....	47	St. George Island.	Niderazof, Isidor.....	26	Do.
Lekanof, Sergius.....	25	Do.	Niderazof, Alexandra..	25	St. Paul Island.
Nozekof, Paul.....	20	Do.	Niderazof, Clement...	4	St. George Island.
Lestenkof, Demetri...	54	Atka, Alaska.	Philomonof, Simeon...	66	Do.
Lestenkof, Alexandra..	37	St. Paul Island.	Philomonof, Zoya.....	24	Do.
Lestenkof, Elizabeth...	9	St. George Island.	Philomonof, Ignati...	17	Do.
Lestenkof, Innokenty..	7	Do.	Philomonof, Julia.....	15	Do.
Lestenkof, Theodore...	4	Do.	Philomonof, Nadesda..	6	Do.
Lestenkof, Michael...	3	Do.	Philomonof, Isaac.....	4	Do.
Lestenkof, Ludmilla...	1	Do.	Philomonof, Andron- ic.	49	Do.
Lestenkof, Michael...	44	Atka, Alaska.	Philomonof, Zenobia...	50	Unalaska, Alaska.
Lestenkof, Oulita.....	47	St. George Island.	Philomonof, Leonti...	22	St. George Island.
Lestenkof, Anna.....	18	Do.	Philomonof, Alexan- dra.	20	Do.
Shabolin, Julia.....	3	Do.	Philomonof, Eoff.....	14	Do.
Malavansky, Nicoli...	52	Do.	Philomonof, Zoya.....	31	St. Paul Island.
Malavansky, Ripsi- mia.	59	Do.	Swetsof, Agnes.....	10	St. George Island.
Malavansky, Wassie...	42	Do.	Swetsof, Eleazar.....	7	Do.
Malavansky, Christo- pher.	12	Do.	Shabolin, Varvara...	19	St. Paul Island.
Malavansky, Julia....	5	Do.	Shabolin, Helena.....	(a)	St. George Island.
Mercuriof, George.....	43	Do.	Prokopiof, Peter.....	52	Attu, Alaska.
Mercuriof, Stepenida...	38	Do.	Prokopiof, Stepenida..	40	St. George Island.
Mercuriof, Peter.....	17	Do.	Prokopiof, Martha....	21	Do.
Mercuriof, Sophia.....	15	Do.	Prokopiof, Marina....	19	Do.
Mercuriof, George, Jr..	13	Do.	Prokopiof, Alexander..	14	Do.
Mercuriof, Nicoli.....	11	Do.	Prokopiof, Laurence...	13	Do.
Mercuriof, Alexandra..	9	Do.	Prokopiof, Fevronia...	11	Do.
Mercuriof, Daniel.....	5	Do.	Prokopiof, Mary.....	10	Do.
Mercuriof, Tetiana....	2	Do.	Prokopiof, Anna.....	8	Do.
Mercuriof, Irene.....	(a)	Do.	Prokopiof, Afanasia...	7	Do.
Mercuriof, Martha....	23	Do.	Prokopiof, Martha, 2d	6	Do.
Mercuriof, John.....	27	Do.	Prokopiof, Helena....	5	Do.
Mercuriof, Sarah.....	23	Do.	Prokopiof, Sophia....	3	Do.
Mercuriof, Mouza.....	3	Do.	Prokopiof, Michael...	1	Do.
Mercuriof, Lubof.....	(a)	Do.	Prokopiof, Alexai....	(a)	Do.
Mercuriof, Joseph.....	45	Do.	Shane, Michael.....	29	Do.
Mercuriof, Katherine...	24	Akutan, Alaska.	Shane, Marina.....	22	Do.
Mercuriof, Polyxenia...	7	St. George Island.	Shane, Serefimia....	(a)	Do.
Mercuriof, Joseph, Jr..	1	Do.	Shane, Riase.....	65	Do.
Mercuriof, Vasil.....	(a)	Do.	Swetsof, Paul.....	24	Do.
Mercuriof, Nicoli.....	36	Do.	Galanin, Fevronia...	39	Do.
Mercuriof, Laurence...	14	Do.	Zacharof, Emanuel...	36	St. Paul Island.
Mercuriof, Benjamin...	11	Do.	Zacharof, Mary.....	42	Do.
Mercuriof, Elizabeth...	9	Do.	Zacharof, Daria.....	14	St. George Island.
Mercuriof, Nicoli, Jr..	7	Do.	Zacharof, Katherine...	11	Do.
Mercuriof, Angelina...	5	Do.	Zacharof, Cleopatra...	(a)	Do.

\* Infant.

Certain statistical details in regard to the natives of St. Paul and St. George Islands are as follows:

**St. Paul Island:**

Resident population June 30, 1916.....	192
Births in period July 1, 1916, to Mar. 31, 1917.....	6
Deaths in period July 1, 1916, to Mar. 31, 1917.....	3
Departures (children to attend Salem Indian Training School at Chemawa, Oreg.) in period July 1, 1916, to Mar. 31, 1917.....	2
Resident population Mar. 31, 1917.....	193

**St. George Island:**

Resident population June 30, 1916.....	119
Births in period July 1, 1916, to Mar. 31, 1917.....	8
Deaths in period July 1, 1916, to Mar. 31, 1917.....	4
Resident population Mar. 31, 1917.....	123

It will be noted that the total native population resident on the islands on March 31, 1917, was 316.

**FUR-SEAL HERD.**

**KILLING OF SEALS.**

*St. Paul Island.*—The first killing of seals on St. Paul Island in 1917 took place on April 6. Killings were continued at intervals until December 17. In all 25 drives were made. The total number of seals killed was 4,986, and a corresponding number of skins was taken.

*St. George Island.*—On St. George Island the first seals were killed on May 28, and killing operations were continued until November 10. Twenty-five drives were made in the year. The number of seals killed in the year was 3,183. In addition to the skins taken from the seals killed, one was secured from a bull found dead on a rookery, the total number of skins secured in the year being, therefore, 3,184.

From the above it will be noted that the total number of fur seals killed on both islands in 1917 was 8,169.

**RECORD OF FUR SEALS KILLED ON ST. PAUL ISLAND, ALASKA, IN THE CALENDAR YEAR 1917.**

Date.	Hauling ground driven.	Num-ber.	Date.	Hauling ground driven.	Num-ber.
Apr. 6	Sivutch (Sea Lion Rock).....	a 57	Oct. 6	Gorbatch—parade ground.....	12
May 31	Reef.....	a 63	16	do.....	25
June 11	do.....	b 73	22	Reef—parade ground.....	305
20	do.....	59	25	do.....	341
30	do.....	a 441	27	do.....	103
July 3	Gorbatch.....	a 325	Nov. 1	Reef and Gorbatch.....	87
7	do.....	382	6	Zapadni.....	25
11	Reef.....	838	7	Reef Peninsula.....	89
16	Tolstoi and Lukanin.....	c 299	10	Reef and Gorbatch.....	41
21	Gorbatch.....	362	Dec. 17	Reef Peninsula.....	92
Aug. 1	do.....	c 389		Seals killed between May 16 and Nov. 10, dates inclusive, by guards at Northeast Point.....	47
4	do.....	234			
10	do.....	a 286			
25	Gorbatch—parade ground.....	6			
Sept. 8	do.....	5		Total.....	4,986

a Includes 1 which died as result of drive, not slaughtered.

b Includes 3 which died as result of drive, not slaughtered.

c Includes 2 which died as result of drive, not slaughtered.

## RECORD OF FUR SEALS KILLED ON ST. GEORGE ISLAND, ALASKA, IN THE CALENDAR YEAR 1917.

Date.	Hauling ground driven.	Num-ber.	Date.	Hauling ground driven.	Num-ber.
May 28	Staraya Artil.....	47	Aug. 19	Zapadni.....	c 1
June 4	East.....	40	23	North.....	c 11
11	North.....	14	28	do.....	c 11
19	East.....	47	Sept. 10	do.....	c 11
20	North.....	57	Oct. 13	do.....	c 4
25	Staraya Artil.....	17	15	do.....	c 5
27	East.....	201	17	do.....	c 10
30	North.....	109	19	do.....	c 7
July 6	Staraya Artil.....	a 115	22	East.....	210
7	East.....	b 314	23	North.....	139
13	Zapadni.....	c 2	23	Staraya Artil.....	73
17	North.....	a 205	26	Zapadni.....	8
17	Staraya Artil.....	406	27	East.....	22
18	Zapadni.....	e 1	30	North.....	56
27	North.....	167	Nov. 2	East.....	126
Aug. 3	East.....	b 338	9	North.....	60
6	Zapadni.....	c 1	10	Staraya Artil.....	35
8	North.....	a 193		Total.....	3,183
10	East.....	a 125			
11	do.....	c 2			

a Includes 1 which died as result of drive, not slaughtered.

b Includes 3 which died as result of drive, not slaughtered.

c Seals snared from edge of bachelors on hauling ground, not taken up in a drive.

The corresponding tables for 1916 in the Report on the Alaska Fisheries and Fur Industries in 1916 <sup>a</sup> were incomplete in respect to details of certain killings made late in the year. In order that these records may be available, the completed tables for 1916 are now published. It will be noted that the number of seals killed on St. George Island was 2 more than the tentative number stated in the 1916 report.

## RECORD OF FUR SEALS KILLED ON ST. PAUL ISLAND IN THE CALENDAR YEAR 1916.

Date.	Hauling ground driven.	Num-ber.	Date.	Hauling ground driven.	Num-ber.
Mar. 3	Sivutch (Sea Lion Rock).....	59	July 29	Northeast Point.....	1
May 27	Reef.....	b 101	Aug. 1	Tolstoi.....	241
30	Northeast Point.....	1	4	do.....	c 117
June 3	Reef.....	67	9	Northeast Point.....	1
3	Polovina.....	1	11	Gorbatch.....	59
7	Northeast Point.....	1	Sept. 3	Northeast Point.....	1
10	Polovina.....	1	4	Gorbatch.....	61
12	Reef.....	209	Oct. 12	Northeast Point.....	1
14	Northeast Point.....	1	do.....	do.....	1
17	Polovina.....	1	17	Tolstoi.....	53
22	Northeast Point.....	1	17	Northeast Point.....	1
23	Reef.....	60	27	Reef Peninsula.....	113
27	Northeast Point.....	1	Nov. 1	Northeast Point.....	1
30	Reef and Gorbatch.....	366	4	Reef.....	73
July 5	Northeast Point.....	1	7	Northeast Point.....	59
6	Gorbatch.....	c 113	8	do.....	23
10	Reef and parade ground.....	d 272	13	Tolstoi.....	44
15	Reef and Gorbatch.....	481	13	Northeast Point.....	1
18	Northeast Point.....	1	15	do.....	1
20	Reef and Gorbatch.....	e 1	28	Reef.....	139
22	Reef.....	93	29	do.....	a 1
24	do.....	f 195	Dec. 5	Northeast Point.....	1
26	Reef and Gorbatch.....	g 284		Total.....	3,483
27	Northeast Point.....	1			
29	Gorbatch.....	c 178			

a Bureau of Fisheries Document No. 838.

b Includes 1 which died on drive and 11 which were suffocated on killing field.

c Includes 1 which died on drive.

d Includes 2 which died on drive.

e Found dead on line of drive of July 15.

f Includes 5 which died on drive.

g Includes 18 which died on drive.

a Found dead; apparently escaped from drive made for killing of November 28.

## RECORD OF FUR SEALS KILLED ON ST. GEORGE ISLAND IN THE CALENDAR YEAR 1916.

Date.	Hauling ground driven.	Num-ber.	Date.	Hauling ground driven.	Num-ber.
June 9	East Cliffs.....	32	Aug. 3	East Cliffs.....	213
13	Zapadni.....	2	5	North.....	145
15	North.....	34	8	East Cliffs.....	40
22	Staraya Artil.....	49	10	North.....	94
22	Zapadni.....	1	10	Zapadni.....	1
24	East Cliffs.....	123	Oct. 16	North.....	1
27	North.....	201	20	Staraya Artil.....	40
29	Staraya Artil.....	55	23	East.....	78
July 1	East Cliffs.....	115	27	Staraya Artil and North.....	88
5	North.....	169	Nov. 1	Zapadni.....	6
7	East Cliffs.....	109	2	North.....	a 72
11	Staraya Artil.....	71	8	Staraya Artil.....	106
12	North.....	295	9	East Reef.....	34
15	East Cliffs.....	355	10	North.....	26
16	Zapadni.....	1	14	North and Staraya Artil.....	b 33
22	do.....	1	16	North.....	12
24	North.....	128	22	Staraya Artil.....	10
27	Zapadni.....	22		Total.....	2,985
29	East Cliffs.....	103			
Aug. 1	North.....	120			

a Includes 1 which died on killing field.

b Includes 1 pup accidentally injured.

The number of skins obtained at the Pribilofs does not necessarily correspond exactly with the number of seals killed, for from time to time a merchantable skin may be obtained from a seal found dead.

*Resumption of commercial killings.*—The drastic restrictions placed upon the killing of fur seals on the Pribilof Islands by the act of Congress, approved August 24, 1912, giving effect to the North Pacific Sealing Convention of July 7, 1911, terminated August 24, 1917. For five years the killing of seals at the islands had been limited by law to the number of animals required for the immediate use of the native inhabitants. The Department planned to place killing operations on a commercial basis upon the termination of the five-year period. Inasmuch as the Governments of Great Britain and Japan are each entitled to a share of sealskins taken commercially on the Pribilof Islands, the time when commercial operations began must be clearly established. This date was August 25, 1917. The number of skins taken on the Pribilofs in the period beginning August 25 and ending December 31, 1917, both dates inclusive, was 1,943. Eleven hundred and sixty-six were taken on St. Paul Island and 777 on St. George Island. Of these 1,943 skins, 1,831 were shipped from the Pribilofs in December, 1,054 from St. Paul, and 777 from St. George.

## UTILIZATION OF WASTE PRODUCTS.

The Bureau continued throughout the year its efforts to utilize in economic ways products of the Pribilofs which have in the past either in part or wholly gone to waste. A serious handicap is the isolation of the islands, which sometimes results in months elapsing before the completion of investigations which under ordinary conditions could be completed in as many weeks or even days.

Among the products which the Bureau has endeavored to develop are bones remaining from former killings of seals and sea lions, seal intestines as sausage casings, oil and gelatine from seal carcasses, corned seal shoulders, canned meat, and the gullets or throats of seals.



*Bone.*—The initial shipments of old bone were made from the Pribilofs in 1917. The first shipment was made on the *Roosevelt* leaving the islands in August. The bone was delivered at Seattle and sold to Elmon A. Geneste, representing the Union Meat Co., of North Portland, Oreg. The shipment amounted to 32,170 pounds, and the Bureau received from Mr. Geneste \$321.70, or at the rate of \$20 per ton. Natives were paid \$179.68 for collecting the material. The balance, \$142.02, was deposited in the Treasury.

The second shipment amounting to 161,400 pounds was made on the *Roosevelt* leaving the islands in December. The material was delivered to Brady & Co., of Seattle, at that place in January, 1918. The price at which it was sold was \$30 per ton, the gross amount being \$2,421. From this there were deductions of \$333.18 for wharfage, labor in unloading, etc., at Seattle. There was also deducted the sum of \$807, paid 55 natives at the islands, who received one-half cent per pound for bone collected. Thus the net amount to be turned into the Treasury was \$1,280.82.

In order that bone might be transported in more compact form, thereby economizing space on the *Roosevelt*, two small crushers were shipped to the islands. Delivery was made at the islands too late in the year to permit the grinding of bone shipped in 1917.

*Intestines.*—A small quantity of salted fur-seal intestines were shipped from St. Paul Island on the *Roosevelt* in December, 1917. Samples of the intestines were submitted to the Bureau of Animal Industry and to the trade. Preliminary tests made with the view of utilizing them for sausage casings were not promising, but observations made in the course of these tests suggested their suitability for sutures, violin strings, tennis rackets, etc. Ordinary so-called catgut of commerce is made from intestines of sheep. Intestines from fur seals are thinner and stronger than those from sheep.

*Oil and gelatine.*—Steps were undertaken to ascertain what possibilities lay in the extraction of oil from seal carcasses. Kettles for use in trying out oil were sent to both St. Paul and St. George Islands, but it may be that any open-kettle process is unsuited for the work. A trial was made on St. Paul Island, using a pressure cooker sent there for experimenting in the canning of seal meat. The blubber, weighing 18 pounds 6 ounces, left on an average fall 3-year-old male seal after removal of the pelt in the regular manner, was minced and cooked for two hours under 19 pounds of steam. The product was then pressed under a small press, yielding 7 pounds 12 ounces of oil, 4 pounds 2 ounces gelatine solution, and 6 pounds 6 ounces residue. Experiments indicate that 1 to 2 gallons of oil, 3 to 8 pounds gelatine, and 30 to 90 pounds of animal meal may be obtained from each seal. A fur-seal flipper weighing 42 ounces yielded 18 ounces transparent gelatine, 2 ounces oil, 16 ounces solids, and 6 ounces of water after cooking two hours under 17 pounds of steam; all four flippers of an average-sized 3-year-old fur seal killed in December weighed 6 pounds. Tests made with blubber shipped from the Pribilofs in 1916 indicated 30 per cent of oil by weight in one case and 38 per cent in another.

*Shoulders.*—A barrel of corned fur-seal shoulders was also shipped from St. Paul Island on the *Roosevelt* in December, 1917. The fol-

lowing extract is taken from a report made by Agent Fassett, who gave attention to them after they reached Washington early in 1918:

These shoulders were packed under the personal supervision of the writer, as follows: Because of the importance of keeping manual labor connected with by-products problems on the seal islands at a minimum, the shoulders were removed from the carcasses without especial care. The native foreman merely detailed a few young men to cut off enough shoulders to fill a barrel, and to send them to the salt house for packing. None of the blubber or fat, the sinews, and other parts which it is usual to remove very carefully when preparing seal meat for use on the officers' mess table, was bothered with; whatever was attached to a piece of meat was left there.

The shoulders were struck in dry salt, using it liberally, and a week later were removed, rinsed, drained, and repacked in the same manner first employed. They were then held in the salt house at a low temperature until a few days prior to shipment by the steamer *Roosevelt* (about Dec. 1, 1917), when they were again repacked in fresh salt. After receipt in Washington a saturated solution of salt and water (brine pickle) was poured over the contents of the barrel so as completely to cover the same.

On March 21, 1918, the writer, in the presence of Dr. Holmes, representing Dr. Langworthy, and Mr. W. T. Bower, of this Bureau, withdrew about a dozen shoulders from the barrel, laying them on a table. All appeared to be thoroughly cured and in "sweet" condition. From these two pieces were selected and sent to the office of Home Economics for testing. They were put into fresh water the same evening to dissolve excess salt, and at noon of the 23d were cooked by experts at the Home Economics office. Meat prepared after the manner of kidney stew, ordinary stew, and fried breakfast hash (with onions and potatoes) was found quite palatable. The samples cooked after the manner of ordinary corned beef, fried steak, and baked or roast meat were not so agreeable. The women who did the cooking could not be prevailed upon to eat of any of the meat, having conceived a disgust for it on account of the very disagreeable marine odor which it gave off while being prepared.

The writer found it possible to eat of each sample, but noted that none was equal to that which it is customary to serve on the St. Paul mess table, prepared from fresh seal meat which has been carefully stripped of all fatty matter, and disguised by sauces, aromatic herbs, and vegetables, larding of pork, bacon, etc.

After a discussion of the matter with Dr. H. F. Moore and Mr. W. T. Bower, the writer is inclined to think that seal shoulders prepared for shipment in the manner herein described will not find a market in the United States, chiefly on account of the very disagreeable marine odor and taste. It is possible that Asiatic Orientals, such as the poorer classes in China and Japan, might absorb a moderate quantity of seal shoulders packed in the manner described.

*Canned meat.*—In September, 1917, the Bureau directed the agent at St. Paul to ship samples of canned fur-seal meat. An apparatus for processing the meat preparatory to canning was sent to St. Paul Island, but was not landed there in time to permit the preparation of samples before the *Roosevelt* left the islands in December.

#### BRANDED SEALS.

As in previous years a number of male seals branded when pups in 1912 were killed in 1917. The skins of 25 of these seals killed on St. Paul Island and of 21 on St. George Island were shipped from the Pribilofs in the year. There were also shipped from St. Paul Island 18 skins taken on that island in September, October, and November, 1916, and from St. George Island 4 skins taken there in October and November, 1916, all from male seals which were branded when pups in 1912.

Certain data were secured in regard to the seals involved and to the skins after removal from the animals. A portion of the data for the skins was recorded at St. Louis in March, 1918. With the exception of the 4 seals killed on St. George Island in October and November, 1916, concerning which the data were very incomplete, certain records secured by the Bureau are shown in the following table:

DATA ON CERTAIN MALE SEALS KILLED, 1916 TO 1917, BRANDED AS PUPS IN 1912.

## FOUR-YEAR-OLDS.

Serial No. of skins.	Date of killing.	Island.	Carcass weight. <sup>a</sup>	Carcass length.	Green skin weight.		Trade classification.
					Pounds.	Ounces.	
P 12733....	Sept. 4, 1916	St. Paul...	Pounds. 91	Inches. 51	9	-----	Small seal.
P 12734....	do.	do.	99	52	11	-----	Do.
P 12735....	do.	do.	127	56.25	12	8	Do.
P 12736....	do.	do.	96	51	11	-----	Do.
P 12737....	do.	do.	77	49	9	8	Do.
P 12738....	do.	do.	120	52.50	13	-----	Middling.
P 12798....	Oct. 17, 1916	do.	125	54	13	8	Do.
P 12906....	Oct. 27, 1916	do.	109	54.50	11	-----	Middling and small.
P 12907....	do.	do.	111	52.25	13	-----	Do.
P 12908....	do.	do.	126	53	13	8	Middling.
P 12909....	do.	do.	151	54.50	14	-----	Do.
P 12910....	do.	do.	117	53.50	13	-----	Do.
P 12911....	do.	do.	82	57.50	11	-----	Do.
P 12912....	do.	do.	115	54.50	12	-----	Small seal.
P 13249....	Nov. 28, 1916	do.	143	59	17	8	Wig.
P 13250....	do.	do.	128	58	14	-----	Middling.
P 13251....	do.	do.	124	57	13	-----	Do.
P 13252....	do.	do.	93	55	12	-----	Do.

## FIVE-YEAR-OLDS.

P 13341....	May 31, 1917	St. Paul...	110.25	56.25	12	8	Middling and small.
P 13376....	do.	do.	103	53	11	12	Small seal.
P 13377....	do.	do.	116.75	57.25	13	-----	Middling.
P 13449....	June 11, 1917	do.	139.75	56	17	4	Do.
P 13450....	do.	do.	115.25	51	11	12	Small seal.
P 13451....	do.	do.	117.75	54.75	14	12	Middling.
P 13452....	do.	do.	111.50	54.75	13	4	Middling and small.
P 13950....	June 30, 1917	do.	112	54.75	12	13	Middling.
P 13951....	do.	do.	119.50	50	13	12	Do.
P 13952....	do.	do.	101.50	49	11	8	Middling and small.
P 13953....	do.	do.	112.50	51.50	15	-----	Middling.
P 13954....	do.	do.	152.50	55.50	20	4	Wig.
P 14279....	July 3, 1917	do.	111.25	55	13	3	Middling.
P 14462....	July 7, 1917	do.	129	57.75	14	9	Do.
P 14463....	do.	do.	126.50	55.75	13	4	Middling and small.
P 15498....	July 11, 1917	do.	119	55	12	10	Do.
P 15499....	do.	do.	110	53.50	12	8	Do.
AP 5759....	Aug. 1, 1917	do.	133	58	14	12	Middling.
AP 5760....	do.	do.	105.50	53.75	13	15	Do.
AP 6065....	Aug. 4, 1917	do.	89	53.75	10	2	Small seal.
AP 6066....	do.	do.	127	57.25	17	7	Middling.
AP 6067....	do.	do.	127	59	17	8	Do.
AP 6449....	Oct. 22, 1917	do.	150.25	56.50	18	8	Wig.
AP 6451....	Oct. 25, 1917	do.	135.50	58	15	-----	Middling.
AP 6452....	do.	do.	166	59.50	19	4	Wig.
AP 6453....	Oct. 27, 1917	do.	162.50	58.75	18	12	Do.
G 5913....	May 28, 1917	St. George.	133	55.25	15	2	Middling and small.
G 5914....	do.	do.	152	59	13	1	Wig.
G 5915....	June 4, 1917	do.	102	53	11	12	Small seal.
G 5916....	do.	do.	134	59.50	14	12	Wig.
G 5919....	June 30, 1917	do.	153	60	17	-----	Do.
G 5921....	July 6, 1917	do.	95	54.75	16	5	Small seal.
G 5922....	July 7, 1917	do.	111	55.50	14	1	Middling.
G 5923....	do.	do.	74.38	55.25	10	12	Small seal.
G 5924....	July 17, 1917	do.	140	60	17	2	Wig.
G 5925....	do.	do.	96	55	13	2	Middling.
G 5926....	July 27, 1917	do.	106	54.25	15	-----	Middling and small.
G 5927....	do.	do.	139	57.25	17	10	Do.
G 5928....	Aug. 3, 1917	do.	104.50	55	16	8	Middling.
G 5929....	Aug. 8, 1917	do.	103	58	15	6	Do.
G 5930....	Aug. 10, 1917	do.	97.50	55.25	13	-----	Middling and small.
G 5931....	do.	do.	133	56.75	16	-----	Middling.
G 5994....	Oct. 23, 1917	do.	109.75	57	20	12	Do.
G 5995....	do.	do.	144.50	62	22	8	Wig.
G 5996....	do.	do.	144.25	62.50	24	8	Do.
G 5997....	do.	do.	116.50	57.50	19	10	Middling.
G 5998....	do.	do.	123.50	62.75	20	14	Do.

<sup>a</sup> Seals were bled before being weighed.

## CENSUS OF THE FUR-SEAL HERD.

A census of the fur-seal herd of the Pribilof Islands was again taken in 1917. The work was under the immediate charge of G. Dallas Hanna. He was assisted by other members of the Alaska service stationed on the Pribilof Islands, and by Dr. Harold Heath, of Stanford University. Transportation between St. Paul and St. George Islands was afforded by the Coast Guard cutter *Unalga* and by the Fisheries steamer *Roosevelt*.

The increased size of the herd, together with the relatively much greater increase in the number of male seals, made the work more difficult than in any previous year and radical changes in methods of procedure were necessary.

For the purpose of showing the numerical strength of the herd in 1917 as compared with the five preceding years, the following table of recent censuses of the herd is given:

GENERAL COMPARISON OF RECENT CENSUSES OF THE SEAL HERD.

Class of seals.	1912	1913	1914	1915	1916	1917
Harem bulls.....	1,358	1,403	1,559	2,151	3,500	4,850
Breeding cows.....	81,984	92,269	93,250	103,527	116,977	128,024
Surplus bulls.....						8,977
Idle bulls.....	113	105	172	673	2,632	2,706
Young bulls (chiefly 5-year olds).....	199	259	1,653			
6-year-old males.....					11,167	15,397
5-year-old males.....				11,271	15,494	14,813
4-year-old males.....	100	2,000	9,939	15,848	15,427	16,631
3-year-old males.....	2,000	10,000	13,880	18,282	19,402	19,507
2-year-old males.....	11,000	15,000	17,422	23,990	24,169	26,815
Yearling males.....	13,000	20,000	23,063	30,307	33,645	38,013
2-year-old cows.....	11,000	15,000	17,422	23,990	24,245	26,917
Yearling cows.....	13,000	20,000	23,067	30,306	33,646	38,018
Pups.....	81,984	92,269	93,250	103,527	116,977	128,024
Total.....	215,738	268,305	294,687	363,872	417,281	468,692

The report submitted by Mr. Hanna considers various phases of the problems connected with the management of the herd in addition to the details of the census. Data in regard to the census are published in another section of this report.

## FOXES.

The taking of fox pelts in the season of 1917-18 for commercial purposes was begun on both St. Paul and St. George Islands in December, 1917. The take on both islands for the season, including a few skins from animals found dead at various times, consisted of 692 blue pelts and 19 white pelts. Information in regard to the operations has been transmitted by radio and is necessarily limited to the more important facts.

*St. Paul Island.*—In the week ending December 31, 1917, 74 blue pelts and 8 white pelts were taken, and in January, 1918, the take consisted of 15 blues and 6 whites. A skin secured in April, 1918, from a blue fox found dead may properly be considered a part of the season's take, inasmuch as it became available for shipment with the others. This makes the total for the season 90 blues and 14 whites.

In the season of 1916-17 there were taken on St. Paul Island 150 blue pelts and 37 white pelts (including one of each taken from foxes

found dead in February, 1917). In the season of 1915-16 the take on this island was 211 blue and 17 white pelts (including 1 white pelt taken in February, 1916, from a fox found dead). It will be noted that the take in the 1917-18 season was considerably less than that of either of the two preceding seasons, the decline from the season of 1915-16 being more than 50 per cent. This small take was made in the face of favorable weather conditions and an increase in the number of traps used. The natives, who receive \$5 for each fox pelt taken, requested that a brief close season be established for the island. The solution of the problem of maintaining on this island a fox herd of a size in keeping with the possibilities probably lies in the adoption of the plan of feeding the foxes for a portion of the year.

*St. George Island.*—In December, 1917, 330 pelts were taken on St. George Island, fox killings having been begun about the middle of the month; in January, 1918, 225 pelts; and in February, 1918, 49 pelts. Including two pelts taken from foxes found dead in November, 1917, and one from an animal found dead in March, 1918, the take for the season of 1917-18 consisted of 602 blue pelts and 5 white pelts. Continued cold weather made it practicable to continue the taking of pelts until February 8. During the season 200 pairs of foxes were captured, marked, and released as breeders. Many foxes not marked also remained on the island augmenting the reserve. The herd was in fine physical condition, and it is believed that the take of pelts will prove to be of a high grade.

#### REINDEER.

On May 19, 1917, there were counted on St. Paul Island 105 adult reindeer and 39 fawns, a total of 144 animals.

On St. George Island the herd on June 30, 1917, consisted of 70 animals aged 1 year and upward and 26 fawns, a total of 96. Three adult males were later killed for food purposes.

The various activities which have been initiated on the Pribilofs recently, coupled with the small force of employees available, made it impracticable to give as much attention to the utilization and development of the reindeer as was desired. However, the herds are able to maintain themselves, are of no expense, do not materially exhaust the resources of the island, and will be available for more intensive care and utilization when circumstances permit.

#### RADIO SERVICE.

The Navy Department kept the radio stations on St. Paul and St. George Islands in commission throughout the year. The services which these stations render to the Bureau's work in affording a prompt means of communication with the islands are invaluable. Cooperation between the personnel of the Bureau of Fisheries and that of the radio service is mutual and of unquestioned value to both services.

#### PATROL OF THE NORTH PACIFIC OCEAN AND BERING SEA.

The act of Congress, approved August 24, 1912, giving effect to the North Pacific Sealing Convention of July 7, 1911, provides, "that it shall be the duty of the President to cause a guard or patrol

to be maintained in the waters frequented by the seal herd or herds and sea otter, in the protection of which the United States is especially interested, composed of naval or other public vessels of the United States designated by him for such service."

The vessels of the Coast Guard are particularly well fitted for the required patrol work and the personnel of the service is thoroughly familiar with the conditions which obtain in the waters to be guarded. For these reasons vessels of the Coast Guard have been utilized exclusively for this work.

The following is a statement prepared by the Coast Guard, describing briefly the character of the patrol work for the season of 1917:

MEMORANDUM CONCERNING OPERATIONS OF THE COAST GUARD IN CONNECTION WITH PATROLLING THE NORTH PACIFIC AND BERING SEA, FOR PROTECTION OF SEALS AND SEA OTTERS, DURING THE SEASON OF 1917.

Owing to war conditions but one cutter, the *Unalga*, was detailed for this patrol in 1917. That vessel left Seattle on May 3, 1917, for Alaskan waters. She took on board at her port of departure a number of sacks of mail for Unalaska and the Pribilof Islands. Three agents of the Bureau of Fisheries were also taken on board for transportation to Unalaska and St. George Island.

On her way north light variable breezes to a fresh southeast gale with thick weather were encountered. An average distance of 18 to 20 miles offshore was maintained and a sharp lookout for fur seals was kept, but no seals were sighted. A stop was made at Sitka, and the voyage resumed on May 9 along the Alaskan peninsula, continuing the lookout for fur seals, but none was seen. A call was made at Kodiak, and then the trip to the westward was resumed, skirting in and around the various islands on the lookout for seals. As weather permitted, patrolled the waters between the Barren Islands and Pearl Island. Arrived at Unalaska on May 29. On June 4 took on board officials, mail, stores, etc. June 7 arrived off the village, St. George Island. On June 8 proceeded to St. Paul Island. After cruising around the islands, returned to Unalaska on June 9, and delivered the mail from the Pribilof Islands for the States.

June 16 sailed for Atka and Attu, and cruised around the Aleutian Islands, stopping at such places as were necessary for rendering assistance to vessels in distress. On June 29 returned to Unalaska.

July 7 left Unalaska on a cruise for Seward and Valdez, calling at several ports en route and continuing the patrol. Performed numerous duties for other departments of the Government at such times as most convenient and desirable, and returned to Unalaska on August 19. Left latter port on August 20 and made another cruise as far as Nazan Bay, off Atka. After making a thorough search in the bays and around the islands of the Aleutian chain, returned to Unalaska on September 5. On September 12, the services of the vessel being no longer required on patrol duty, started for the States, stopping en route at Akutan, Valdez, Bear Bay, Ketchikan, and Point Colpoys, arriving at Seattle on October 1.

During the entire season the *Unalga* steamed a total of 12,892.3 miles, boarding 33 vessels and assisting 3.

Along with the patrol work the Coast Guard each year renders invaluable assistance to the Bureau in the way of transporting employees, mail, and supplies, acknowledgment for which is here made.

From time to time the Coast Guard also cooperates in enforcing the fisheries laws at isolated points along the Alaskan coast. Work of this kind is usually done in connection with the performance of the regular duties of that service.

SEALING PRIVILEGES ACCORDED ABORIGINES.

The North Pacific Sealing Convention of July 7, 1911, provided that Indians, Aleuts, or other aborigines dwelling on the Pacific coast of North America north of the thirtieth parallel of north latitude might carry on pelagic sealing in canoes not transported by or used in connection with other vessels, and propelled entirely by oars, paddles, or sails, and manned by not more than five persons each,

in the way hitherto practiced and without the use of firearms; and provided that such aborigines are not in the employment of other persons, or under contract to deliver the skins to any person. However, section 4 of the act of April 21, 1910 (36 Stat., 326), prohibits the killing of fur seals together with other fur-bearing animals within the limits of Alaska Territory or in the waters thereof, and empowers the Secretary of Commerce "to authorize the killing of any such \* \* \* fur seal, \* \* \* under such regulations as he may prescribe." The Secretary of Commerce has not exercised the power granted by this latter provision; so, at the present time under the provisions of this statute the killing of fur seals within the Territory of Alaska or in the waters thereof is absolutely prohibited. For the purposes of this act the waters of Alaska extend offshore to the 3-mile limit.

The act approved August 24, 1912, giving effect to the North Pacific Sealing Convention forbids bringing into the United States any skins taken from seals belonging to the American fur-seal herd of the North Pacific Ocean unless they are officially marked and certified as having been legally taken. Indians or other aborigines subject to the jurisdiction of the United States should make prompt application to the Commissioner of Fisheries or to a representative of the Bureau of Fisheries for the marking and authentication of any fur-seal skins lawfully taken by them.

In May, 1917, two fur seals were taken by a native of Sitka, Alaska, off Biorka Island, outside the 3-mile limit. It was reported that both were males. The skins obtained were subsequently authenticated by a representative of the Bureau.

Through the courtesy of the Department of the Interior, Dr. C. L. Woods, superintendent and physician, United States Indian Service, Neah Bay, Wash., authenticated sealskins legally taken by Indians in the coastal waters off the State of Washington. Reports submitted by Dr. Woods indicate that 517 skins taken in 1917 were authenticated by him. The skins were taken in the months of May and June. With the exception of five taken west of Ozette, all were secured 20 or 25 miles west of La Push. The seals from which the skins were taken were speared from canoes. The records indicated that 209 were males, 304 females, sex undetermined in respect to 4 pups.

#### SHIPMENTS OF SKINS FROM PRIBILOF ISLANDS IN 1917.

*Fur-seal skins.*—On July 30 there were placed aboard the steamer *Roosevelt* at the Pribilofs 2,823 St. Paul skins and on August 1, 2,059 St. George skins. These skins, 4,882 in number, were delivered at Seattle by the *Roosevelt* August 18. They were then shipped August 19 by freight consigned to Funsten Bros. & Co., St. Louis, Mo. The shipment left Seattle via the Northern Pacific Railway Co., and was delivered at St. Louis early in September.

A second shipment of fur-seal skins from the Pribilofs in 1917 was made in December. This shipment consisted of 1,630 St. George skins and 2,628 taken on St. Paul Island, a total of 4,258 skins. This shipment was also made on the *Roosevelt*, which arrived with them at Seattle on January 14, 1918. The skins were reshipped at Seattle January 15 via the Northern Pacific Railway, consigned to Funsten Bros. & Co., and were delivered at St. Louis in February.

*Fox skins.*—The fox skins taken at the Pribilofs in the season of 1916-17 were placed aboard the *Roosevelt* July 30-31 and were delivered by the vessel at Seattle August 18. The skins were re-shipped the same day, consigned to Funsten Bros. & Co., St. Louis, via Wells, Fargo & Co. Express. The shipment consisted of 150 blue pelts and 37 white pelts from St. Paul Island and 417 blues and 2 whites from St. George Island; a total of 567 blues and 39 whites, making a grand total of 606 skins.

#### SALES OF FUR-SEAL SKINS.

Three sales of fur-seal skins from the Pribilof Islands were held at St. Louis, Mo., by Funsten Bros. & Co. in the calendar year 1917. The skins were sold at auction to the highest bidders. The dates of the sales were January 29, April 18, and October 8, respectively. The total number of skins sold was 6,739, all of which had previously been dressed, dyed, and machined.

At the sale on January 29, 1917, the number of skins sold was 2,000. They brought \$93,678 gross, an average of \$46.84 per skin. For the purposes of the sale the 2,000 skins were divided into 30 lots. The highest prices obtained were for a lot of 33 skins, which brought \$1,980, an average of \$60 per skin. The minimum price obtained for any pelt was \$25. The following table shows details in regard to the sale:

DETAILS OF SALE OF 2,000 DRESSED, DYED, AND MACHINED PRIBILOF ISLANDS FUR-SEAL SKINS AT ST. LOUIS, JAN. 29, 1917.

Lot No.	Number of skins.	Trade classification.	Price per skin.	Total for lot.
3505.....	33	12 middlings; 21 middlings and smalls.....	\$60	\$1,980
3506.....	50	Middlings and smalls.....	56	2,800
3507.....	70	Smalls.....	50	3,500
3508.....	70	do.....	50	3,500
3509.....	70	do.....	50	3,500
3510.....	70	do.....	53	3,710
3511.....	70	do.....	55	3,850
3512.....	41	do.....	55	2,255
3513.....	80	Large pups.....	47	3,760
3514.....	80	do.....	49	3,920
3515.....	80	do.....	48	3,840
3516.....	80	do.....	48	3,840
3517.....	80	do.....	48	3,840
3518.....	80	do.....	48	3,840
3519.....	80	do.....	48	3,840
3520.....	80	do.....	48	3,840
3521.....	80	do.....	47	3,760
3522.....	46	do.....	47	2,162
3523.....	45	do.....	49	2,205
3524.....	90	Middling pups.....	42	3,780
3525.....	90	do.....	43	3,870
3526.....	90	do.....	45	4,050
3527.....	90	do.....	43	3,870
3528.....	90	do.....	43	3,870
3529.....	51	do.....	45	2,295
3530.....	50	do.....	44	2,200
3531.....	42	Small pups.....	40	1,680
3532.....	35	III.....	25	875
3533.....	36	III.....	25	900
3534.....	51	Cuts, etc.....	46	2,346
Total.....	2,000			93,678



The following table shows a summary of the trade classifications and the percentage of the total number in each class:

SUMMARY OF TRADE CLASSIFICATIONS AND PERCENTAGE IN EACH CLASS OF THE FUR-SEAL SKINS SOLD AT ST. LOUIS, JAN. 29, 1917.

Trade classification.	Number in class.	Percentage.
Small pups.....	47	2.35
Middling pups.....	592	29.60
Large pups.....	860	43.00
Smalls.....	412	20.60
Middlings and smalls.....	77	3.85
Middlings.....	12	.60
Total.....	2,000	100.00

At the second sale in 1917, held on April 18, the number of skins sold was 1,500. These skins brought \$68,540.50 gross, an average of \$45.69 per skin. The maximum price per skin was \$60 and the minimum \$22.50. The following table shows details in regard to the sale:

DETAILS OF SALE OF 1,500 DRESSED, DYED, AND MACHINED PRIBILOF ISLANDS FUR-SEAL SKINS AT ST. LOUIS, APRIL 18, 1917.

Lot No.	Number of skins.	Trade classification.	Price per skin.	Total for lot.
11100.....	56	30 middlings.....	\$60.00	\$3,360.00
11101.....	70	26 middlings and smalls.....		
11102.....	80	Middlings and smalls.....	50.00	3,500.00
11103.....	80	Smalls.....	49.00	3,920.00
11104.....	80	do.....	52.00	4,160.00
11105.....	71	do.....	48.00	3,408.00
11106.....	80	Large pups.....	51.00	4,080.00
11107.....	80	do.....	50.00	4,000.00
11108.....	80	do.....	47.00	3,760.00
11109.....	80	do.....	47.00	3,760.00
11110.....	80	do.....	51.00	4,080.00
11111.....	90	Middling pups.....	43.00	3,870.00
11112.....	90	do.....	42.00	3,780.00
11113.....	80	do.....	40.00	3,200.00
11113.....	75	3 middlings.....	42.00	3,150.00
11113.....	75	6 middlings and smalls.....		
11113.....	75	18 smalls.....		
11113.....	75	24 large pups.....		
11113.....	75	23 middling pups.....		
11114.....	75	1 small pup.....	41.00	3,075.00
11114.....	75	2 middlings.....		
11114.....	75	7 middlings and smalls.....		
11114.....	75	18 smalls.....		
11114.....	75	24 large pups.....		
11115.....	60	23 middling pups.....	25.50	1,530.00
11115.....	60	1 small pup.....		
11115.....	60	2 middlings.....		
11115.....	60	7 middlings and smalls.....		
11115.....	60	20 smalls.....		
11116.....	59	22 large pups.....	22.50	1,327.50
11116.....	59	9 middling pups.....		
11116.....	59	2 middlings.....		
11116.....	59	6 middlings and smalls.....		
11116.....	59	20 smalls.....		
11117.....	24	21 large pups.....	57.00	1,368.00
11117.....	24	9 middling pups.....		
11117.....	24	2 middlings.....		
11117.....	24	6 middlings and smalls.....		
11117.....	24	20 smalls.....		
11118.....	63	21 large pups.....	55.00	3,465.00
11118.....	63	9 middling pups.....		
11118.....	63	2 middlings.....		
11118.....	63	6 middlings and smalls.....		
11118.....	63	20 smalls.....		
11119.....	68	21 large pups.....	48.00	3,264.00
11119.....	68	9 middling pups.....		
11119.....	68	2 middlings.....		
11119.....	68	6 middlings and smalls.....		
11119.....	68	20 smalls.....		
11120.....	33	21 large pups.....	39.00	1,287.00
11120.....	33	9 middling pups.....		
11120.....	33	2 middlings.....		
11120.....	33	6 middlings and smalls.....		
11120.....	33	20 smalls.....		
11121.....	26	21 large pups.....	46.00	1,196.00
11121.....	26	9 middling pups.....		
11121.....	26	2 middlings.....		
11121.....	26	6 middlings and smalls.....		
11121.....	26	20 smalls.....		
Total.....	1,500			68,540.50

The following table shows a summary of the trade classifications and the percentage of the total number in each class:

SUMMARY OF TRADE CLASSIFICATIONS AND PERCENTAGE IN EACH CLASS OF THE FUR-SEAL SKINS SOLD AT ST. LOUIS, APRIL 18, 1917.

Trade classification.	Number in class.	Percent-age.
Small pups.....	3	0.2
Middling pups.....	357	23.8
Large pups.....	574	38.26
Smalls.....	381	25.4
Middlings and smalls.....	143	9.54
Middlings.....	42	2.8
Total.....	1,500	100.00

At the third sale in 1917, held October 8, the number of skins sold was 3,239. These skins brought \$107,447 gross, averaging \$33.17 each. The following table shows details in regard to the sale:

DETAILS OF SALE OF 3,239 DRESSED, DYED, AND MACHINED PRIBILOF ISLANDS FUR-SEAL SKINS AT ST. LOUIS OCT. 8, 1917.

Lot No.	Number of skins.	Classification.	Price per skin.	Total for lot.
1.....	65	{10 wigs.....	\$43.00	\$2,795.00
2.....	50	{55 middlings.....		
3.....	50	Middlings and smalls.....	42.00	2,100.00
4.....	50	do.....	45.00	2,250.00
5.....	50	do.....	41.50	2,075.00
6.....	50	do.....	42.50	2,125.00
7.....	50	do.....	41.50	2,075.00
8.....	80	Smalls.....	33.50	2,680.00
9.....	80	do.....	38.50	3,080.00
10.....	80	do.....	31.50	2,760.00
11.....	80	do.....	39.00	3,120.00
12.....	80	do.....	34.50	2,760.00
13.....	80	do.....	37.50	3,000.00
14.....	80	do.....	35.00	2,800.00
15.....	80	do.....	33.00	2,640.00
16.....	80	do.....	32.50	2,600.00
17.....	43	do.....	31.00	2,720.00
18.....	80	do.....	30.00	1,290.00
19.....	80	Large pups.....	28.50	2,280.00
20.....	80	do.....	35.50	2,840.00
21.....	80	do.....	34.00	2,720.00
22.....	80	do.....	33.50	2,680.00
23.....	80	do.....	33.00	2,640.00
24.....	80	do.....	31.00	2,480.00
25.....	80	do.....	35.00	2,800.00
26.....	80	do.....	32.00	2,560.00
27.....	80	do.....	31.00	2,480.00
28.....	80	do.....	34.50	2,760.00
29.....	80	do.....	35.50	2,840.00
30.....	80	do.....	37.00	2,960.00
31.....	80	do.....	38.00	3,040.00
32.....	91	do.....	31.50	2,866.50
33.....	80	Middling pups.....	32.50	2,600.00
34.....	80	do.....	32.00	2,560.00
35.....	80	do.....	30.00	2,400.00
36.....	80	do.....	32.50	2,600.00
37.....	80	do.....	32.50	2,600.00
38.....	80	do.....	34.50	2,760.00
39.....	109	do.....	31.00	3,379.00
40.....	61	Small pups.....	32.00	1,952.00
		{2 middlings and smalls.....	23.50	1,527.50
		{9 smalls.....		
		{24 large pups.....		
		{18 middling pups.....		
		{12 small pups.....		

DETAILS OF SALE OF 3,239 DRESSED, DYED, AND MACHINED PRIBILOF ISLANDS FUR-SEAL SKINS AT ST. LOUIS OCT. 8, 1917—Continued.

Lot No.	Number of skins.	Classification.	Price per skin.	Total for lot.
41.....	48	III. { 4 middlings and smalls..... 15 smalls..... 29 large pups.....	\$18.50	\$888.00
42.....	62	III. { 54 middling pups..... 8 small pups..... 1 middling.....	17.00	1,054.00
43.....	45	IV.. { 11 smalls..... 33 large pups..... 50 middling pups.....	14.00	630.00
43½.....	80	IV.. { 28 small pups..... 2 extra small pups.....	12.00	960.00
Total.....	3,239			107,447.00

The following table shows a summary of the size classifications and the percentage of the total number in each class:

SUMMARY OF SIZE CLASSIFICATIONS AND PERCENTAGE IN EACH CLASS OF THE FUR-SEAL SKINS SOLD AT ST. LOUIS OCT. 8, 1917.

Trade classification.	Number in class.	Percentage.
Extra small pups.....	2	0.06
Small pups.....	109	3.37
Middling pups.....	711	21.95
Large pups.....	1,217	37.57
Smalls.....	878	27.11
Middlings and smalls.....	256	7.91
Middlings.....	56	1.73
Wigs.....	10	.30
Total.....	3,239	100.00

The number of fur-seal skins from the Pribilof Islands on hand in the States on December 31, 1916, was 11,457. Forty-eight hundred and eighty-two skins were received from the Pribilofs in 1917. The aggregate number of skins sold in 1917 was 6,739. The number of fur-seal skins from the Pribilof Islands on hand in the States on December 31, 1917, was, therefore, 9,600. In this connection it should be noted that on December 31, 1917, there were 4,258 additional skins aboard the steamer *Roosevelt* en route from the Pribilofs to Seattle.

SALE OF FOX SKINS.

The fox skins shipped from St. Paul and St. George Islands in 1917 were sold at St. Louis by Funsten Bros. & Co. on October 8, 1917. The 567 blue-fox skins brought \$34,653.50 gross, averaging \$61.11 each; the 39 white-fox skins \$1,027 gross, averaging \$26.33 each. The following table shows details in regard to the sale of these skins.

DETAILS OF SALE OF 567 BLUE-FOX SKINS AND 39 WHITE-FOX SKINS FROM PRIBILOF ISLANDS AT ST. LOUIS, OCT. 8, 1917.

Lot No.	Number of skins.	Trade classification.	Price per skin.	Total for lot.
Blue-fox skins:				
79.....	6	Extra fine dark.....	\$101 00	\$606.00
80.....	9	Fine dark.....	93.00	837.00
81.....	4	I extra large dark.....	97.00	388.00
82.....	8	I and II extra large dark.....	79.00	632.00
83.....	8	I dark.....	87.00	696.00
84.....	10	II dark.....	77.00	770.00
85.....	12	II dark low.....	59.00	708.00
86.....	12	do.....	58.00	696.00
87.....	16	III dark.....	42.00	672.00
88.....	12	I blue.....	73.00	876.00
89.....	12	do.....	74.00	888.00
90.....	8	II extra large blue.....	72.00	576.00
91.....	10	II blue.....	61.00	610.00
92.....	10	do.....	63.00	630.00
93.....	12	II blue low.....	52.00	624.00
94.....	12	do.....	71.00	852.00
95.....	12	III blue.....	30.00	360.00
96.....	10	I pale.....	60.00	600.00
97.....	8	II pale.....	44.00	352.00
98.....	10	II pale low.....	36.00	360.00
99.....	10	III pale.....	31.00	310.00
100.....	14	IV.....	18.00	252.00
101.....	10	I and II.....	75.00	750.00
102.....	4	Extra fine dark.....	142.00	568.00
103.....	4	do.....	117.00	468.00
104.....	4	do.....	111.00	444.00
105.....	4	Extra large fine dark.....	115.00	460.00
106.....	9	Fine dark.....	93.00	837.00
107.....	4	I extra large dark.....	96.00	384.00
108.....	12	I dark.....	85.00	1,020.00
109.....	7	I dark point silver.....	88.00	616.00
110.....	10	II dark.....	78.00	780.00
111.....	8	do.....	66.00	528.00
112.....	14	II dark low.....	60.00	840.00
113.....	10	I blue.....	79.00	790.00
114.....	6	II extra large blue.....	69.00	414.00
115.....	12	II blue.....	52.00	624.00
116.....	10	II blue low.....	54.00	540.00
117.....	14	III blue.....	41.00	574.00
118.....	6	I pale.....	52.50	315.00
119.....	9	II pale.....	47.00	423.00
120.....	13	IV.....	17.50	227.50
121.....	8	I and II.....	79.00	632.00
122.....	4	Extra fine dark.....	107.00	428.00
123.....	9	Fine dark.....	98.00	882.00
124.....	4	I extra large fine dark.....	101.00	404.00
125.....	10	I dark.....	90.00	900.00
126.....	8	I and II extra large dark.....	72.00	576.00
127.....	10	II dark.....	79.00	790.00
128.....	12	II dark low.....	62.00	744.00
129.....	16	III dark.....	38.00	608.00
130.....	12	I blue.....	68.00	816.00
131.....	8	II extra large blue.....	53.00	424.00
132.....	10	II blue.....	54.00	540.00
133.....	13	II blue low.....	51.00	663.00
134.....	14	III blue.....	27.00	378.00
135.....	9	I pale.....	62.00	558.00
136.....	6	II pale.....	51.00	306.00
137.....	16	IV.....	6.50	104.00
138.....	3	Skins.....	1.00	3.00
White-fox skins:				
730.....	11	I.....	31.00	341.00
731.....	14	II.....	28.50	399.00
732.....	14	13 I and II stained.....	20.50	287.00
		14 III.....		
Total.....	606			35,680.50

## FUR-SEAL CENSUS, PRIBILOF ISLANDS, 1917.

By G. DALLAS HANNA.

### SCOPE OF 1917 CENSUS.

In each of the five summers preceding that of 1917 a complete census was taken of the fur seals resorting to the Pribilof Islands in so far as this was possible, that is, all the adult males and all the young of the season were actually counted. On account of the large influx of male seals resulting from the cessation of commercial killing each succeeding census was marked by increased difficulties.

In 1916 it was barely possible to count all the pups with the force available. While a complete pup count could not be made in 1917, a sufficient proportion of the pups was enumerated to establish good averages which were applicable to the remainder. The 1917 census is therefore entirely comparable with the five preceding ones, and owing to its greater detail probably second to none in accuracy taken previous to 1912.

The rookery rocks which were numbered and marked with white paint by the Coast and Geodetic Survey in 1897 were repainted and relocated where necessary. This work was carried as nearly to completion as possible. The photographic stations occupied by the 1895 investigation were relocated and marked with paint. All these data were plotted on Coast Survey charts.

At the height of the breeding season harem bulls and idle bulls were counted on all the rookeries on St. George and St. Paul Islands. Hauling-ground seals were estimated at the same time. The breeding areas were carefully plotted on Coast Survey charts at this time. A complete series of photographs was taken from the historical stations of 1895.

After the height of the breeding season was over and the bulls had lost much of their viciousness, but before the pups had learned to swim, the latter were counted on eight rookeries on St. Paul Island and on three rookeries on St. George Island.

From these data obtained in the above-described field work a computation of the entire number of seals was made. The computation was intended to be complete to August 10, 1917.

### HABITS OF FUR SEALS.

To begin an account of the fur-seal herd as it now exists it is necessary to outline briefly the important facts in its life history which have a direct bearing upon the methods of study pursued. Complete accounts have been published many times in the past and are readily accessible.

The mature females or cows arrive at the islands mostly between June 15 and July 15 and give birth to one young from a few hours to a few days after coming ashore. Cows have been seen as early as

May 26 and newborn young have been seen in September. The adult males, called bulls, are all in position when the cows come and dot the breeding ground checker-board fashion. The cow seems to have no choice of a rookery nor to any great extent of a bull. When she is ready to land she ventures out shyly but a short distance at first and is intercepted by one of the water-line tier of bulls. She then slips from one bull to another back up through the breeding area toward the rear. Probably this is mostly done at night, but it is commonly observed in the day. After she finally becomes settled she lies down quietly to sleep.

The newborn pup is jet black and weighs 10 to 12 pounds. Its eyes are open and it moves around within 15 minutes usually. The mother cares little for it, as a rule. She has been seen to lift it out of crevices of rocks and out of the way of the bull as he stampedes across the harem area. When very young the mother will often stand by it against man. But after she once returns to the water and again comes back she will desert the pup on the slightest provocation.

Pups begin to swim in the first half of August while their hair is still black, but not until they have completely shed the milk dentition. Soon after taking to the water they begin to shed the black hair and by the end of September it has been replaced on most of them by a coat of glistening silvery gray. They then swim farther and farther from the parent rookery and eventually cruise, in schools, completely around the islands. But they return to land periodically, probably to the parent rookery in every case, where the mothers come to meet them. Here they nurse and upon the rich milk they get exceedingly fat. They have not been known to feed upon anything except milk before they leave the islands for the winter migration. Before they depart many weigh more than 50 pounds. In November they go south through the Aleutian passes.

Each cow weighs 50 to 100 pounds and is of the same color as the males, 2, 3, and 4 years old, as well as of the same size. Their whiskers are black the first three years, but begin to turn white in the fourth year. Thus they are very difficult to distinguish from the bachelors.

The bulls are very much larger than the cows. They weigh 400 or 500 pounds and are usually of a rusty red color. They have a bristly mane about 2 inches long on the back of the neck and are vicious and ugly in disposition. They arrive at the islands from the end of April to the height of the breeding season. Here they soon haul out and get into position to await the coming of the cows. Some of them have to wait two or three weeks and some do not get cows at all. They establish themselves on an average of 18 feet apart and remain on their small plats, called harem areas, without food or drink until August 1 or later. During this time they live on a thick layer of blubber with which they are covered when they arrive. Before leaving they become very thin. Much sparring and bluffing take place between neighbors and occasionally there is a fight to the finish, in which the loser is driven to sea.

Cows quietly and gradually slip into the rookeries thus fully occupied by bulls. But there are not enough to make each harem of full capacity for every bull. Therefore the harems around the rear margins are usually very small, containing only one or a few cows,

while the centrally located bulls regularly get 75 or more in many cases.

Back of the line where the last cows extend there are still more bulls in position to which no cows come. These are called idle bulls. Then there are roaming bands of younger males here and there back of the idle bull lines.

At the ends or in the middle of all the larger rookeries, paths are left open in the breeding masses of seals for the young males, called bachelors, to haul up to the rear of the rookeries on the plats, called hauling grounds. The bulls never permit the bachelors to mingle with the cows nor even to pass through the rookery elsewhere than the regular runway.

These bachelors are composed of males 2 to 6 years old. They haul back on land to rest, sleep, and play for a week or more, then go to sea to feed. Some old bulls also haul out on the hauling grounds, especially those that have been severely injured on the rookeries. Also, after August 1, an occasional yearling comes out on the hauling grounds.

The yearlings, as a class, arrive at the islands after August 15. They scout the margins of the rookeries only and play with the pups, which are then just learning to swim. The yearlings are very small and thin as a rule; in fact, many weigh less than when they left the islands in the previous November. There is considerable variation in the coloration of all classes and ages of seals, but the yearlings do not differ as a rule from the 2-year-olds in this respect. Females and males are alike externally, and together play with the pups.

After August 1 the rigid harem discipline is relaxed, the pups begin to "pod" back of the rookeries as well as swim, and the cows follow them. Then by August 15 there is a general prowling over the rookeries by young bulls and many cows resort to the hauling grounds to play and sleep. The breeding heat has then practically passed for males as well as females. Some 2-year-old cows only remain to be impregnated, and these are served by the younger bulls roaming over the breeding grounds. The 2-year-old cows arrive late in the breeding season after most of the others have given birth to their pups.

The hauling-ground seals are the important ones commercially. They are practically all males in June and July. They occupy areas of their own and can be driven like sheep to a selected spot for killing without any disturbance of the breeding classes. The older ages come first in the spring, and killings can usually be made in the latter part of May. The 2-year-olds, the smallest of the lot, do not arrive in large numbers until after July 1.

#### THE PUPS.

The count of pups used to begin on July 26. This was attended with some difficulty owing to the presence of bulls, cows in heat, and newborn young, but no serious obstacles were encountered. In 1916 the large influx of bulls made it necessary to defer some of the counting as late as August 15. This is objectionable because some of the pups are swimming on that date and the number in the water must be estimated. It is highly desirable, therefore, to complete all pup counting before that date.

In 1917 the count was started on August 2, the first day it was practicable to enter the rookeries without danger to human life, and by the 9th so many pups had taken to the water that further counting was omitted. Results which would have been obtained thereafter would have had such a percentage of error due to the swimming pups that they would have been much less satisfactory than actual counts earlier in the season.

In all, eight of the St. Paul and three of the St. George rookeries were counted entirely and the dead on two other rookeries on St. Paul Island were carefully counted. The figures give a good basis for ascertaining the average harem on those rookeries which were not counted, and have been so used. Results are shown in the tables following:

## DISTRIBUTION OF PUPS AT THE PRIBILOF ISLANDS IN 1917.

Rookery.	Date of counts.	Living pups.	Dead pups.	Total pups.
ST. PAUL ISLAND.				
Kitovi.....		a 2,482	a 38	2,520
Lukanin.....	Aug. 3..	2,174	61	2,235
Gorbach.....		a 8,346	a 303	8,649
Ardiguen.....		a 713	a 13	726
Reef.....	Aug. 7..	16,985	457	17,442
Sivutch.....		a 4,933	a 127	5,060
Lagoon.....	Aug. 2..	401	5	406
Tolstoi.....		a 15,085	a 348	15,433
Zapadni.....	Aug. 6..	9,567	261	9,828
Little Zapadni.....		a 6,640	a 223	6,863
Zapadni Reef.....	Aug. 6..	348	10	358
Polovina.....	Aug. 9..	4,753	165	4,918
Polovina Cliffs.....	do	1,707	54	1,761
Little Polovina.....	do	1,245	15	1,260
Morjovi.....		a 2,824	97	2,921
Vostochni.....		a 26,989	1,260	28,249
Total.....		105,252	3,437	108,689
ST. GEORGE ISLAND.				
North.....		a 6,614	a 169	6,783
Staraya Artil.....		a 5,530	a 112	5,642
Zapadni.....	Aug. 6..	1,033	17	1,050
South.....	do	24		24
East Reef.....	Aug. 4..	1,762	24	1,786
East Cliffs.....		a 3,959	a 91	4,050
Total.....		18,922	413	19,335
Total, both islands.....		124,174	3,850	128,024

• Estimated.



## PERCENTAGE OF INCREASE OR DECREASE IN THE NUMBER OF PUPS IN 1917 FROM 1916.

Rookery.	Total pups 1916.	Total pups, 1917.	Percentage of increase (+) or de- crease (-).
ST. PAUL ISLAND.			
Kitovi.....	2,472	a 2,520	b + 1.94
Lukanin.....	2,141	2,235	+ 4.39
Gorbach.....	8,864	a 8,649	b - 2.49
Ardiguen.....	700	a 726	b + 3.71
Reef.....	16,331	17,442	+ 6.80
Sivutch.....	5,020	a 5,060	b + .79
Lagoon.....	388	466	+20.10
Toistoi.....	12,065	a 15,433	b +27.91
Zapadni.....	9,682	9,828	+ 1.51
Little Zapadni.....	6,277	a 6,863	b + 9.35
Zapadni Reef.....	266	358	+34.58
Polovina.....	4,744	4,918	+ 3.66
Polovina Cliffs.....	1,683	1,761	+ 4.63
Little Polovina.....	1,074	1,260	+17.31
Morjovi.....	2,761	a 2,921	b + 5.79
Vostochni.....	24,387	a 28,249	b +15.83
Total.....	98,855	108,689	+ 9.94
ST. GEORGE ISLAND.			
North.....	6,246	a 6,783	b + 8.50
Staraya Artil.....	5,545	a 5,642	b + 1.74
Zapadni.....	965	1,050	+ 8.80
South.....	19	24	+26.31
East Reef.....	1,585	1,786	+12.68
East Cliffs.....	3,762	a 4,050	b + 7.65
Total.....	18,122	19,335	+ 6.69
Total, both islands.....	116,977	128,024	+ 9.44

a Estimated.

b Based on estimated number of pups in 1917.

## PERCENTAGE OF ANNUAL INCREASE OF PUPS, 1912-1917.

Year.	Number of pups.	Percent- age of increase.
1912.....	81,984	-----
1913.....	92,269	12.54
1914.....	93,250	1.06
1915.....	103,527	11.02
1916.....	116,977	12.99
1917.....	128,024	9.44

It will be noted that the percentage of increase of pups for the herd is 9.44. The difference in the increase on the two islands may appear strange, but is entirely in accord with the facts gathered through six years of counting, and conforms to the general law of fur seals that their instincts cause them to flock to the centers of greater numbers; and the smallest rookeries grow most slowly.

This increase of 9.44 per cent is below what is generally believed to be the normal of 11 per cent. We see a reason for this in the lean year of 1914. Female pups born then gave birth to their first pups in 1917. Therefore the small increase in 1914 should be felt in 1917. Another factor which goes to make a small increase may be somewhat noticeable this year. This is the death rate of cows on land. In 1913, 1914, and 1915 the number of dead cows noted during the count on the rookeries was considered negligible. But in 1916 there was a

large increase in the percentage and again in 1917. This, however, was foreseen by all students of the subject. With an increase of bulls and the reduction of the average harem there must of necessity be an increase in the dead and injured cows in the harems.

The increased death rate of pups, due to the increase of bulls in 1916, can not be felt as a decrease of births until 1919 and should be most noticeable in 1920 when the results of the minimum average harem of 1917 will show. The increased death rate of pups on land due to any cause is certain to show as a decrease in births three years later. Of course the large size of the herd might make it almost imperceptible in a single year, when complete rookery observations are impossible, but the results are there and cumulative and can not be ignored.

During the count careful lookout was kept for signs of mange, uncinaria, etc. The mange appeared in 1914 to a noticeable extent, reached a maximum in 1915, and has grown less and less since. At the present time no serious trouble can be foreseen from this source because the percentage of seals afflicted is negligible. Mange affects the adults as well as the young and usually appears as round spots on the back. Here the guard hairs fall out, exposing the light-brown underfur. Such spots have been known to the trade as "rubbed places," but no rubbing action, such as would produce them, is possible by the fur seal.

As a result of the counting done two pups, both on St. Paul, were lost. One was smothered in a pod and the other was killed by a bull.

#### DEAD PUPS.

The increase in the percentage of dead pups keeps pace with the reduction of the average harem and the increase of bulls. As the bulls increase and get closer together on the rookery areas, there is more fighting and charging back and forth over the pups so that the number of dead will increase proportionately. Thus it has now become 3.01 per cent of the total, whereas it was under 2 per cent in 1914, when the average harem was treble what is found on many rookeries at present.

Still no very alarming results can be foreseen from the present death rate on land. Of course the loss of females is cumulative and important for that reason. By keeping the average harem at a minimum, and it has doubtless been close to that in 1917, the loss of pups due to the trampling of the bulls can not be expected to go much, if any, over 3 per cent.

This loss is under the control of man. He can make it 3 per cent or 2 per cent as he chooses by the simple expedient of controlling the number of males; that is, by increasing the average harem. It can not be done in a year, nor as the herd exists at present, in several years. But after the surplus piled up during the six seasons of closely restricted killings shall have become eliminated and the current quotas of killables are utilized systematically, there seems to be no obstacle in the way of keeping the average harem the size most desirable.

## NUMBER AND DISTRIBUTION OF DEAD PUPS IN 1917.

Rookery.	Total pups.	Dead pups.	Percentage of dead.	
			1917	1916
ST. PAUL ISLAND.				
Kitovi.....	a 2,520	a 38	b 1.50	1.09
Lukanin.....	2,235	61	2.72	4.01
Gorbatch.....	a 8,649	a 303	b 3.50	2.84
Ardiguen.....	a 726	a 13	b 1.79	1.00
Reef.....	17,442	457	2.62	1.12
Sivutch.....	a 5,060	a 127	b 2.50	1.37
Lagoon.....	466	5	1.07	.77
Tolstoi.....	a 15,433	a 348	b 2.25	1.21
Zapadni.....	9,828	261	2.65	1.51
Little Zapadni.....	a 6,863	a 223	b 3.24	2.38
Zapadni Reef.....	358	10	2.79	1.50
Polovina.....	4,913	165	3.35	2.38
Polovina Cliffs.....	1,761	54	3.06	1.18
Little Polovina.....	1,260	15	1.19	1.39
Morjovi.....	a 2,921	97	b 3.32	1.59
Vostochni.....	a 28,249	1,260	4.46	3.70
Total.....	108,689	3,437	3.16	2.19
ST. GEORGE ISLAND.				
North.....	a 6,783	a 169	b 2.49	1.98
Staraya Artil.....	a 5,642	a 112	b 1.98	1.53
Zapadni.....	1,050	17	1.61	.82
South.....	24			
East Reef.....	1,786	24	1.34	1.07
East Cliffs.....	a 4,050	a 91	b 2.24	2.07
Total.....	19,335	413	2.13	1.72
Total, both islands.....	128,024	3,850	3.00	2.12

a Estimated.

b Based on estimated number of pups.

## THE BREEDING COWS.

## LOSSES AT SEA.

The fate of the fur-seal herd is directly dependent upon the breeding females. To prove this statement it is only necessary to refer to the fact that only two males are required to 100 females for breeding purposes, and it should be the object of the Government to spare no efforts in the protection and conservation of the females.

The number of breeding females in any one year is known to be equal to the number of young because each cow gives birth annually to one pup. Therefore the cows have increased from 81,984 in 1912 to 128,024 in 1917. This is a gain of 46,040 or 56.16 per cent, an average increase for five years of 9.36 per cent. This annual percentage of increase of the class in which we have most concern appears and is low, but it should be constantly borne in mind that it can not be expected, naturally, to materially increase in the future. During these five years the cows have had almost absolute protection as far as molestation by man is concerned. The great loss occurs at sea from unknown causes. It is known that the whales of the genus *Orca* devour seals to a greater or less extent, and if this is not the chief enemy there must be another which lives at sea and is at present unknown. The losses at sea in the first three years of their lives have been found to approximate 50 per cent of the seals born.

## AGES OF COWS.

It is a well-established fact that the female seal begins her breeding career when 2 years old and brings forth her first pup when 3 years old. The male, however, is unable to breed under normal conditions until he is 7 years old. The length of the breeding period of both these classes is a very important matter and unfortunately is not very well known. It can only be learned from branded animals, and the number which can be thus marked is manifestly an insignificant portion of the total. For several seasons, the average breeding period of the cow has been placed at 10 years.

In 1900, 1901, and 1902 a number of pups were branded with a bar across the middle of the back. Some of these have returned annually ever since, and a photograph of one was printed in the report of the fur-seal investigation in 1914.<sup>a</sup> Altogether five were seen in 1917. This is very significant because the time given to search for them was exceedingly limited. It demonstrates, however, beyond question that the female does live 15, 16, or 17 years; that is, she can have 12, 13, or 14 pups. From this it appears that the deduction of 10 per cent from the breeding-cow class each year for old-age mortality is entirely sufficient.

## THE 3-YEAR OLD COWS.

It is well to again test the natural mortality of the seals by applying the knowledge we have of the breeding cows, the same as has been done for two years past. The total number of breeding cows in 1916 was 116,977. By deducting the 10 per cent loss from old-age mortality, as explained above, of these in 1917 there should remain 105,280. To this number there was an increment of 22,744 composed, of 3-year-old females born in 1914, which brings the total up to 128,024. It is easy to ascertain the loss of female pups born in 1914 which would leave these 22,744. The total number of pups born that year was 93,350, half of which, or 46,625, should have been females. If the losses for the first three years had been exactly 50 per cent there would have been an increment of 23,312 in place of the 22,744, which has been computed. This is as close as a calculation of this character could be expected to come. It is entirely possible in one case that the births of males exceeded the females in 1914 by 568, which would make up the difference. And again it is possible that the loss varies to a certain extent each year and may sometimes run a little under or over this 50 per cent. At any rate this seems a very safe basis to work from and has been used in all deductions from all classes for natural mortality during the first three years of the seals' lives.

## THE 5-YEAR-OLD BRANDED COWS.

Little can be said about the cows which were branded as pups in 1912 and were 5 years old in 1917. They were seen on practically every rookery and throughout the breeding season. The animals appeared normal in every respect and the brands seen were very distinct. Compared with unbranded cows on the rookeries they appeared very young. While they had not in most cases acquired the complete mask of white whiskers, they were much more

white than they had been the previous year. It is now believed that the whiskers of both sexes turn white at about the same age. Thus in most animals they begin to turn in the fourth year and are entirely white by the sixth. In size the 5-year-olds appeared fully adult.

#### HAREM AND IDLE BULLS.

Many of the data contained in this and in all preceding reports on the fur-seal herd have been derived from those classes of adult animals known as harem and idle bulls. These comprise both the males which are participating in the procreation of the species at the time of the height of the breeding season, known as harem bulls or harem masters, and that surplus skirting the margins of the rookeries which is unable to get cows, known as idle bulls.

Many facts go to make the adult male the subject of most trustworthy evidence respecting the seal herd. In the first place, he is four or five times as large as the female and therefore easily seen at a distance. Under average conditions of the sealing industry practically all of the bulls haul out of the water on the breeding areas in June and locate themselves 15 to 20 feet apart, where they stay until about the first of August. Thus the entire number can be counted.

In 1917 the average number of square feet of space occupied by each bull and his harem was determined, and since 1912 the average number of cows each one has been able to get has been obtained. Figuring from these bases it is now possible to make a fairly accurate census of the seal herd from a count of bulls alone at the height of the breeding season.

The count of bulls is known officially as the height-of-season harem count or just harem count. A full realization of its importance is had by all persons having knowledge of the fur-seal herd. It is very important that it be made as nearly as possible on the same dates year after year, and just as accurately as possible. It takes about a week to make the count.

Some rookeries are best counted from a boat, and others from a long ladder held upright at various places. Those which give most trouble are Zapadni and Reef on St. Paul, because the seals occupy a sloping beach which can not be seen from behind and a table-land which can not be seen from a boat. The crest between these areas should be marked in some way to assist in this work.

Preliminary counts are always made to acquire familiarity with the general distribution of the masses and the approximate numbers to be expected when the height of the season arrives. The dates chosen as representing the height of the season have been well established and mark the period when the largest number of bulls and cows are present on the rookeries.

Most of the harem bulls arrive and get into their positions on the rookeries before any appreciable numbers of cows arrive at the islands. The distance they were apart varied within the maximum and minimum of 24 and 12 feet in 1917, and the average was 18 feet. Each one knows the boundaries of his area, and any intrusion thereon promptly starts a battle. The bulls were about four jumps apart. Naturally when they are fewer they are farther apart and each one has more cows.

Those males actually having cows at the height of the season are recorded as harem bulls whether they have one cow or a hundred. Naturally with an abundance of bulls, as in 1917, there would be a

greater percentage of one-cow harems and the average would be correspondingly reduced. But there is a minimum beyond which the average can not go, because one cow per bull is impossible.

Those males which are in position about the margins of the breeding areas to receive cows but are without them are called idle bulls. In past years when bulls were scarce many young bulls 4, 5, and 6 years old came about the areas and necessitated the enumeration of a separate class, namely, the young bulls. But with the number of adult males existing in 1917 the younger animals have no chance to hold a position within reach of the cow masses, so that this class has been done away with as an integral part of the height-of-the-season harem count. All bulls about the breeding grounds in position to receive cows are either harem or idle bulls.

It was very evident in 1917 that even the adult males give up hope of securing cows if they can not get within a certain distance of them at the height of the breeding season. This distance seemed to be about equal to three layers of idle bulls on most rookeries. Thus if a bull comes to a rookery late and can not get within this distance he skirts the rear a time or two and then hauls away. The large number of idle bulls naturally provokes a great deal of fighting among them at the rear of the rookeries. This abandonment of the rookery areas was well illustrated in 1917 by the numbers of adult bulls hauled among the bachelors at the height of the breeding season. And this condition necessitated the computation of an additional class in 1917, known as surplus bulls. Their number must be estimated, not a very satisfactory procedure, but no counts worthy of notice are possible for a basis. As these animals haul with the bachelors they are taken up with that class.

The total number of harem bulls found in 1917 was 4,850, and idle bulls 2,706, a total of 7,556, as shown in the following table:

HAREM AND IDLE BULLS IN 1917.

Rookery.	Date.	Harem bulls.	Idle bulls.	Total.
<b>ST. PAUL ISLAND.</b>				
Kitovi.....	July 16	126	56	182
Lukanin.....	..do....	100	54	154
Gorbach.....	..do....	279	130	409
Ardiguen.....	..do....	33	28	61
Reef.....	July 17	613	237	850
Sivutch.....	..do....	184	72	256
Otter Island.....	July 31	.....	1	1
Lagoon.....	July 18	24	15	39
Tolstoi.....	..do....	671	180	851
Suthetunga.....	..do....	2	64	66
Zapadni.....	..do....	420	342	762
Little Zapadni.....	..do....	259	70	329
Zapadni Reef.....	..do....	22	13	35
Polovina.....	July 19	166	130	296
Polovina Cliffs.....	..do....	87	31	118
Little Polovina.....	..do....	35	51	86
Morjovi.....	..do....	127	83	210
Vostochni.....	..do....	1,018	784	1,802
<b>Total.....</b>		<b>4,166</b>	<b>2,341</b>	<b>6,507</b>
<b>ST. GEORGE ISLAND.</b>				
North.....	July 25	266	114	380
Staraya Artil.....	..do....	163	113	276
Zapadni.....	July 26	33	17	50
South.....	..do....	6	6	12
East Reef.....	July 24	81	54	135
East Cliffs.....	..do....	135	61	196
<b>Total.....</b>		<b>684</b>	<b>365</b>	<b>1,049</b>
<b>Total, both islands.....</b>		<b>4,850</b>	<b>2,706</b>	<b>7,556</b>

The next table, which shows percentages of gains of these classes, is very instructive. Thus harem bulls increased 38.57 per cent from 1916, while the idle bulls only increased 2.81 per cent. This in the presence of an enormous number of adult males out on the hauling grounds seems to be conclusive proof that when a bull can not get within about three places of a mass of cows he gives up and quits trying. If this proves true in succeeding years it means that the percentage of idle bulls to harem bulls will not normally be far from 50 when these classes exist in sufficient abundance to maintain the minimum average harem. The fact that this percentage went to 75 in 1916 and that the average harem was 33 (not the minimum as then suspected) means nothing more than that the idle bulls as a class were young and not able to secure cows from the stronger harem masters. If the average harem in 1916 had been at a minimum and the percentage of idle bulls 75, while in 1917 the harem had remained minimum, but idle bulls dropped to 55.7 per cent, it would be very suggestive that there were fewer bulls in the latter year. But since this is known absolutely not to have been the case, the explanation on the basis that the idle bull ceases to be one if he can not get within a certain distance of the cows seems justifiable.

In the light of this recently acquired knowledge, it would seem to have been permissible to have classed a portion of this 75 per cent of idle bulls in 1916 as young bulls. But since this is an indefinite division at best, it is believed it might have proved misleading.

## COMPARISON OF HAREM AND IDLE BULLS IN 1917 WITH 1916.

Rookery.	Harem bulls.			Idle bulls.			Total.		
	1916	1917	Gain.	1916	1917	Gain.	1916	1917	Gain.
ST. PAUL ISLAND.									
Kitovi.....	95	126	32.63	44	56	27.27	139	182	30.93
Lukanin.....	64	100	56.25	45	54	20.00	109	154	41.28
Gorbatch.....	234	279	19.23	110	130	18.18	344	409	18.89
Ardiguen.....	33	33		9	28	211.11	42	61	45.23
Reef.....	490	613	25.10	269	237	a 11.88	759	850	11.98
Sivutch.....	162	184	13.58	111	72	a 35.13	273	256	a 6.22
Otter Island.....					1			1	
Lagoon.....	13	24	84.61	8	15	87.50	21	39	85.71
Tolstoi.....	361	671	85.87	335	180	a 46.26	696	851	22.27
Suthetunga.....		2			64			66	
Zapadni.....	309	420	35.92	332	342	3.01	641	762	18.87
Little Zapadni.....	178	259	45.50	157	70	a 55.41	335	329	a 1.79
Zapadni Reef.....	8	22	175.00	1	13	1,200.00	9	35	288.88
Polovina.....	162	166	2.47	90	130	44.44	252	296	17.46
Polovina Cliffs.....	59	87	47.45	47	31	a 34.04	106	118	11.32
Little Polovina.....	31	35	12.90	21	51	142.85	52	86	65.38
Morjovi.....	95	127	33.68	88	83	a 5.68	183	210	14.75
Vostochni.....	654	1,018	55.65	611	784	28.31	1,265	1,802	42.45
Total.....	2,948	4,166	41.31	2,278	2,341	2.76	5,226	6,507	24.51
ST. GEORGE ISLAND.									
North.....	200	266	33.00	103	114	10.67	303	380	25.41
Staraya Artil.....	142	163	14.78	109	113	3.66	251	276	9.96
Zapadni.....	31	33	6.45	47	17	a 63.82	78	50	a 35.89
South.....	3	6	100.00		6		3	12	300.00
East Reef.....	73	81	10.95	44	54	22.72	117	135	15.38
East Cliffs.....	103	135	31.06	51	61	19.60	154	196	27.27
Total.....	552	684	23.91	354	365	3.10	906	1,049	15.78
Total both islands.....	3,500	4,850	38.57	2,632	2,706	2.81	6,132	7,556	23.22

a Loss.

## THE AVERAGE HAREM.

Too much stress can not be placed upon the value of ascertaining the average number of cows per bull on the several rookeries and for the herd as a whole. This has long been recognized as one of the best methods of census calculation. The first pup counts ever made were on small rookeries to determine the average harem there, and this factor was applied to the total number of bulls. Thus the total number of cows was obtained and from it the other classes could be deduced. Naturally the value of the process depended upon the applicability to the herd as a whole of the conditions on the one or two rookeries on which pups were counted. It has been found through five years of complete pup counts that a few rookeries consistently have average harems approaching that of the whole. These rookeries should, of course, be taken as a type when only partial counts can be made.

This was done in 1917. Those rookeries were taken for counting which seemed from observations on the ground and from former conditions to have approximately the averages of the herd. The full details of the reasoning followed in then arriving at the average harems on those rookeries which were not counted are shown elsewhere.

It is practically certain that the average number of cows to each bull in 1917 was a minimum of 26.39. And it is just as true now as ever that the number of idle bulls makes this large or small. When the idle bulls are few the average harem is large; when they are many it is small.

In 1917 the percentage of idle bulls to harem bulls was 55 and the average harem 26.39. It is a safe inference, therefore, that whenever the percentage of idle bulls equals or exceeds this figure the average harem will not be far from the minimum. The importance of this fact will be appreciated in future census work when the herd has developed beyond the possibilities of pup counting. The following table of average harems for six years is very instructive. While the curves of each rookery have a general similarity to that of the total, very few are exact enough to furnish an indication of what the average harem will be in future years.

THE AVERAGE HAREM IN THE YEARS 1912-1917, INCLUSIVE.

Rookery.	1917	1916	1915	1914	1913	1912
ST. PAUL ISLAND.						
Kitovi.....	a 20.00	26.0	39.9	36.5	42.2	37.3
Lukanin.....	22.35	33.4	42.5	47.0	50.3	47.0
Gorbach.....	a 31.00	37.9	45.9	54.9	60.1	59.0
Ardiguen.....	a 22.00	21.2	25.3	43.7	43.2	37.9
Reef.....	28.45	33.3	50.2	70.3	81.8	72.7
Sivutch.....	a 27.50	31.0	47.3	44.5	52.2	48.9
Lagoon.....	19.41	29.8	26.3	46.9	87.8	65.1
Tolstoi.....	a 23.00	33.4	49.0	61.7	80.4	88.1
Zapadni.....	23.40	33.3	50.5	66.9	75.0	70.1
Little Zapadni	a 26.49	35.3	53.6	54.7	79.2	72.7
Zapadni Reef	16.27	33.2	31.3	68.7	65.7	62.0
Polovina.....	29.62	29.3	59.4	61.3	83.6	62.2
Polovina Cliffs	20.24	28.5	47.1	65.9	69.4	51.6
Little Polovina	36.00	34.6	50.7	51.5	50.0	76.5
Morjovi.....	a 23.00	29.1	46.9	53.8	70.3	64.9
Vostochni.....	a 27.74	37.3	53.0	67.7	66.4	63.2
Total.....	26.08	33.53	49.27	60.3	69.6	65.0

a Derived from estimates



## THE AVERAGE HAREM IN THE YEARS 1912-1917, INCLUSIVE—Continued.

Rookery.	1917	1916	1915	1914	1913	1912
ST. GEORGE ISLAND.						
North.....	a 25.50	31.2	40.6	56.4	41.5	38.1
Staraya Artil.....	a 34.61	39.0	50.0	67.9	64.0	69.4
Zapadni.....	31.81	31.1	43.0	73.1	67.0	38.9
South.....	4.00	6.3	8.7			
Little East.....	22.04	21.7	34.9	26.0	12.5	26.0
East Reef.....		36.5	41.4	41.5	26.1	23.3
East Cliffs.....	a 33.00			46.6	48.9	41.2
Total.....	28.26	32.82	42.51	57.1	49.1	42.5
Total, both islands.....	26.39	33.42	48.13	59.8	65.8	60.4

a Derived from estimates.

Some rookeries, which in the earlier years had averages which approximated the whole, later made considerable deviations therefrom. And the converse is true. No area can be said to constantly contain the average development of the herd in a single phase. But no other method is known whereby as accurate an estimate can be obtained as by the average harem method. Small rookeries, however, should not be considered in any deductions of this sort because they are erratic in development and growth and are subject to much greater variations than the larger ones.

## AVERAGE HAREM AND PERCENTAGE OF IDLE BULLS TO HAREM BULLS, 1916 AND 1917.

Rookery.	1916				1917			
	Breed- ing cows.	Harem bulls.	Average harem.	Percent- age idle bulls to harem bulls.	Breed- ing cows.	Harem bulls.	Average harem.	Percent- age idle bulls to harem bulls.
ST. PAUL ISLAND.								
Kitovi.....	2,472	95	26.0	46.3	a 2,520	126	20.0	44.4
Lukanin.....	2,141	64	33.4	70.3	2,235	100	22.3	54.0
Gorbach.....	8,864	234	37.9	47.0	a 8,649	279	31.0	46.5
Arduquen.....	700	33	21.2	27.3	a 726	33	22.0	84.8
Reef.....	16,331	490	33.3	54.9	17,442	613	28.4	38.6
Sivutch.....	5,020	162	31.0	68.5	a 5,060	184	27.5	39.1
Lagoon.....	388	13	29.8	61.5	466	24	19.4	62.5
Toistol.....	12,065	361	33.4	92.8	a 15,433	671	23.0	26.8
Suthetunga.....					2			3,200.0
Zapadni.....	9,682	309	31.3	107.4	9,828	420	23.4	81.4
Little Zapadni.....	6,277	178	35.3	88.2	a 6,863	259	26.4	27.0
Zapadni Reef.....	266	8	33.2	12.5	358	22	16.2	59.0
Polovina.....	4,744	162	29.3	55.5	4,918	166	29.6	78.3
Polovina Cliffs.....	1,683	59	28.5	79.7	1,761	87	20.2	35.6
Little Polovina.....	1,074	31	34.6	67.7	1,260	35	36.0	145.7
Morjovi.....	2,761	95	29.1	92.6	a 2,921	127	23.0	65.3
Vostochni.....	24,337	654	37.3	93.4	a 28,249	1,018	27.7	77.0
Total.....	98,855	2,948	33.53	77.27	108,689	4,166	26.08	56.19
ST. GEORGE ISLAND.								
North.....	6,246	200	31.2	51.5	a 6,783	266	25.5	42.8
Staraya Artil.....	5,545	142	39.0	76.8	a 5,642	163	34.6	69.3
Zapadni.....	965	31	31.1	151.6	1,050	33	31.8	51.5
South.....	19	3	6.3		24	6	4.0	100.0
East Reef.....	1,585	73	21.7	60.3	1,786	81	22.0	66.6
East Cliffs.....	3,762	103	36.5	49.5	a 4,050	135	30.0	45.1
Total.....	18,122	552	32.82	64.13	19,335	684	28.26	53.36
Total, both islands.....	116,977	3,500	33.42	75.20	128,024	4,850	26.39	55.79

a Based on estimated number of pups.

The relation which the percentage of idle bulls to harem bulls bears to the average harem is shown in the table above. On following this line of data back there is seen to be a general relation on the rookeries where many idle bulls gather year after year. But as the idle-bull class as a whole moves and shifts about some, little can be gathered therefrom which can be made use of in the estimates for future years. The most important fact there shown is that a large percentage of idle bulls causes a small average harem.

### HAULING-GROUND SEALS.

In 1914 it was attempted to make a simultaneous count of all seals on all hauling grounds in order that a positive statement could be made of the exact number present on a particular date. No greater value was placed upon the operation. All agree that it might differ on two consecutive days by several thousand because the bachelors are a moving, shifting lot, never stationary for any length of time, and governed to a certain extent in their movements by the weather. It takes a large force to make this count simultaneously on every rookery, much larger, in fact, than has been available since 1914.

At the time of the height-of-the-season harem count it is not difficult to stir up the sleeping bachelors and estimate their numbers. Any attempt to separate the young bulls from the bachelors for separate count would be folly. The two classes intergrade. A reasonable approximation to the numbers of each may be had by determining the proportion of each on one or two hauling grounds and applying this to the whole. This is as close as the value of the count warrants. In fact, it can not be seen how the results to be gained from this phase of the work justify the expenditure of any appreciable amount of time. Acting upon these premises, the following results were obtained in 1917. Dates are the same as in the height-of-season harem count table.

HAULING-GROUND SEALS ASHORE IN 1917 AT THE HEIGHT OF THE BREEDING SEASON,  
JULY 16-26.

Rookery.	Total.	Rookery.	Total.
ST. PAUL ISLAND.		ST. GEORGE ISLAND.	
Kitovi.....	38	North.....	1,025
Lukanin.....	340	Staraya Artil.....	750
Gorbach.....	940	Zapadni.....	120
Reef.....	4,384	East Reef.....	647
Sivutch.....	300	East Cliffs.....	684
Tolstoi.....	1,240		
Zapadni.....	3,160	Total.....	3,226
Little Zapadni.....	700		
Zapadni Reef.....	45	Grand total.....	22,323
Polovina.....	3,000		
Little Polovina.....	250		
Morjovi.....	1,500		
Vostochni.....	3,200		
Total.....	19,097		

Thus there were somewhat over 20,000 seals on the hauling grounds at the height of the season. It has long been believed that the number on land at one time is about one-fifth of the total. This

would indicate over 100,000 in existence, a figure differing not greatly from the one derived later in this report from the birth rates. (See census summary, p. 123.)

This table contains actual counts in some cases. Here it was found there were 25 per cent as many bulls, old and young, as bachelors. This would make 5,580 of the former and 16,743 of the latter. It was manifestly impossible to determine the proportion of old and young bulls with any degree of accuracy worthy of notice.

#### THE DATA ON ROOKERIES WHERE COUNTING OF PUPS WAS NOT DONE.

It is admitted by all that an actual count of all living and dead pups is the best known means of arriving at a close estimation of all classes of seals in the herd. But when the number has increased to such an extent that complete pup counts become impracticable other means must be devised. Several methods may be considered.

##### 1. AREA COMPUTATION.

In the early days of sealing, when the herd was very large as compared with its present size, this was the only method considered in arriving at a census. Thus Charles Bryant, the first agent of the Treasury Department on the Pribilofs, used it, and so far as known originated it. He was followed by H. W. Elliott in 1872-74 and again in 1890. His work was exhaustive, but the results were such that they received severe criticism. So bitter was the fight waged that the actual good in the area method of computation was lost sight of and was scarcely again considered until 1917.

The basis of any computation by this method must of necessity be a unit of area for each seal. A close approximation of the total breeding areas of any and all rookeries can be obtained by plotting them on charts. Then the division of the area by the unit gives the total number of cows, bulls, and pups in the space. The accuracy of the method depends upon (a) the skill of the observer in sketch-map work and (b) the correctness of the seal unit. Regarding the first, little can be said. The writer would consider Elliott's areas as given in his several reports very accurate indeed. His skill in delineation is well recognized. In 1915 and 1916 the writer plotted the breeding areas on the large scale Coast and Geodetic Survey charts of the rookeries at the height of the breeding season. Little time, however, could be given to this phase of the work, and it was attempted solely to give a general idea of the location of the breeding masses. Greater accuracy was not desired.

In 1917 A. C. Reynolds was detailed to assist in the seal-census work, and his training as a civil engineer especially fitted him for this phase of the work. His results are entirely satisfactory, and, coupled with other information related to census work, these give, in the writer's opinion, the most comprehensive view of area calculations which has so far been possible.

The unit of area assumed by Elliott to be occupied by each seal was 2 square feet. He made allowances for the difference in size of the bulls, cows, and pups, and the fact that only about one-half the cows are present at any one time on the rookeries. But he did not

have the means of getting this unit from actual counts on known areas. He appears to have been unduly influenced by large level massed areas and did not allow for much more enormous spaces, fully occupied, but less dense, owing to topographical features. At any rate, his results differed widely from conditions as they exist to-day.

In 1917 careful counts were made of harems on all rookeries and entire pup counts on 11 rookeries. Then the areas of all breeding grounds were ascertained. Thus there was secured the unit, as well as it was possible to get it, on 11 rookeries. These take in all types of topography found here. Some were small rookeries, but on the major ones the unit runs from 7 to 9 square feet per breeding seal. The following table gives this information concretely:

AREAS OF PRIBILOF ISLANDS ROOKERIES IN 1917 AND SEAL UNITS.

Rookery.*	Rookery space.	Seals.	Area to each seal.	Area to each harem.	Average distance apart of bulls.
ST. PAUL ISLAND.					
	<i>Square feet.</i>		<i>Square feet.</i>	<i>Square feet.</i>	<i>Feet.</i>
Kitovi*.....	50,715	5,166	9.81	402.5	20.0
Lukanin.....	37,170	4,570	8.13	371.7	19.3
Gorbach*.....	103,950	17,577	5.91	372.5	19.3
Arduen*.....	18,855	1,485	12.69	571.3	23.9
Reef.....	236,250	35,497	6.65	385.4	19.6
Sivutch*.....	41,850	10,304	4.06	227.4	15.1
Lagoon.....	6,930	956	7.24	288.7	17.0
Tolstoi*.....	166,320	31,537	5.27	247.8	15.7
Zapadni.....	149,850	20,076	7.46	356.7	18.8
Little Zapadni*.....	66,420	13,985	4.74	256.4	16.0
Zapadni Reef.....	3,330	738	4.51	151.4	12.3
Polovina.....	69,300	10,002	6.93	417.4	20.4
Polovina Cliffs.....	36,090	3,609	10.00	414.8	20.4
Little Polovina.....	11,386	2,555	4.45	325.3	18.0
Morjovi*.....	41,130	5,969	6.89	323.8	18.0
Vostochni*.....	315,000	57,516	5.47	309.4	17.6
Total.....	1,354,546	221,542	6.11	325.1	18.0
ST. GEORGE ISLAND.					
North*.....	49,680	13,832	3.59	186.7	13.6
Staraya Artil*.....	51,300	11,447	4.48	314.7	17.7
Zapadni.....	19,710	2,133	9.24	597.3	24.4
East Reef.....	18,135	3,653	4.96	223.8	15.0
East Cliffs*.....	33,480	8,235	4.06	248.0	15.7
Total.....	172,305	39,300	4.38	251.9	15.9
Grand total.....	1,526,851	260,842	5.85	314.8	17.7

\* Rookeries marked with an asterisk are those upon which complete counts of pups were not made and these were estimated by the average harem method as explained on page 108. South rookery, St. George Island, on which all pups were counted, is omitted from this tabulation. It had but 24 pups in 1917.

The average area per seal is seen to be about 6 square feet. The area per bull was obtained by dividing the areas by the number of harems which were found; and the distance each bull was apart is the square root of the area each occupied.

Such data as these are very valuable for use in conjunction with partial counts for arriving at a complete census after the herd is too large for all pups to be counted. It is to be regretted they have not been obtained since 1912 along with the complete counts. We would now have had concrete knowledge of the seal unit of area such as is obtainable only when the herd is small.

The accuracy of computing complete censuses from areas is not as great as from actual pup counts, and in 1917 it was not believed to be as reliable for computing the numbers on the rookeries not counted as the average harem based on a partial pup count with the average harem on the same rookeries which were counted this year. We know better the number of animals on a rookery by comparison with it in former years than we would know by assuming that the unit is the same for it as for some other which was counted. It so happens, however, that the two methods come out with more exactness than was at first anticipated. Rookeries not counted but estimated upon the basis of the average harem show a seal unit in close approximation to that found on rookeries which were counted.

The area method and the seal unit should be of increasing value as the herd grows from year to year until finally it supersedes all other methods. But as long as possible every known method of census work should be run in conjunction with every other, because at best any seal census can not be more than a close approximation to the truth.

## 2. THE AVERAGE HAREM ON ROOKERIES WHERE PUPS WERE NOT COUNTED.

While it was suspected on the islands that the increase in cows was not up to normal even before any pups were counted, owing to lack of expansion of certain breeding areas, it was well known after the first few rookeries had been counted. The percentage of increase of the pups, the number of dead pups, the expansion of the breeding areas, and the average harem all pointed to the same general result and indicated early about what the total number of breeding cows would be. It so happened, however, that Lukanin and Zapadni, the first rookeries counted, ran low-average harems this year, while last year they were normal. Conclusions drawn from those alone would have been fallacious, as subsequent counting proved, but after it was known that the percentage of increase in pups was approximately 9, it was evident about what the total number of breeding cows would be. This left the necessity, however, of assuming an arbitrary figure for the average harem on those rookeries which could not be counted.

Realizing the importance of determining the average number of cows to each bull on these rookeries as closely as possible, every phase of the sealing industry since 1912 was carefully considered. Naturally, one of the most instructive helps in this was the table of average harems for those years, as shown. When the known figures were placed in the proper columns, figures for the unknown were immediately suggested; but this was not enough. The table which follows was computed. It was run back to 1915 only, because previous to that the scarcity of bulls made the average harem a conjectural and inconstant quantity.

AVERAGE HAREMS IN 1915, 1916, AND 1917 ON ROOKERIES ON WHICH THE PUPS WERE COUNTED IN 1917.

Rookery.	1917	1916	1915
ST. PAUL ISLAND.			
Lukanin.....	22.35	33.45	42.5
Reef.....	28.45	33.32	50.2
Lagoon.....	19.42	29.8	26.3
Zapadni.....	23.40	33.3	50.5
Zapadni Reef.....	16.27	33.2	31.3
Polovina.....	29.62	29.3	59.4
Polovina Cliffs.....	20.24	28.5	47.1
Little Polovina.....	36.00	34.6	50.7
Average.....	26.08	31.9	49.82
ST. GEORGE ISLAND.			
Zapadni.....	31.81	31.1	43.0
South.....	6.00	6.3	8.7
East Reef.....	22.04	21.7	34.9
Average.....	23.83	24.0	36.82
General average.....	25.92	31.25	48.80

The significant portions of these data are the totals as compared with the totals for the entire herds for each island shown as follows:

	St. Paul Island.		St. George Island.		Both islands.	
	1916	1915	1916	1915	1916	1915
Average harem for rookeries on which pups were counted in 1917.....	31.90	49.82	24.00	36.82	31.25	48.80
Average harem for herds.....	33.53	49.27	32.82	42.51	33.42	48.13

Thus it is seen that in 1915 the average harem for the rookeries counted in 1917, 48.80, almost exactly coincided with the average for the herd, 48.13. The difference was 0.67 over. In 1916 the difference was 2.17 in the other direction. It would seem this indicates with sufficient clearness that if the average harem for the herd in 1917 is placed at 25.92, which was found on 11 rookeries, it will be within 2 of being correct. As the total number of harems was 4,850 it makes the possible error in the total number of breeding cows 9,700. The maximum error coefficient in this enumeration therefore becomes 7.71 per cent. It is regretted that this is so high, but there are no known means whereby it can be reduced when a complete pup count is not practicable. Upon consideration of all other data this is not as discouraging as it might seem at first glance.

The further the subject progresses the greater appears the necessity of assuming that the average harem for the entire herd is near that of the rookeries upon which counts were made. It can not vary more than two from this. Upon the completion of all calculations and when all assumptions had been made for rookeries not counted, the average harem for the herd was raised from 25.92 to 26.39, as shown in table on page 109. The principal influence bringing about this change was the fact that the average for the herd in 1916 was 2.17 greater than the average on the same rookeries counted in

1917. Had the average for the herd been placed 2 greater than that found on the 11 rookeries counted, however, it would have placed the total number of cows at 135,000, an increase which observations do not indicate as having taken place.

In deciding upon the average harems for those rookeries not counted which, together with those counted, would make the grand average 26.39, due consideration was given to make that estimate in every case conservative.

If the maximum variation allowable, 2.17, had been split in two and the average for the herd been placed at 27.08, it would have indicated that more cows came back than we now figure; that is, the loss was not 50 per cent during the first three years of the seals' life or the loss due to old age was not 10 per cent of the breeding cow class. Either of these conditions may be true and either makes the count as recorded herein farther on the side of safety; that is, it is much more apt to be under the actual figures than over, and this is as it should be. No absolute law can be established for losses at sea, and the percentages are undoubtedly subject to more or less variation from year to year, due to causes of which we at present have no knowledge.

### 3. PERCENTAGES OF DEAD PUPS AND PERCENTAGES OF INCREASE.

Before saying definitely what the total number of pups on a rookery which is not counted shall be in a season when other rookeries are counted, consideration should be given to two other factors than the average harem and the areas. These are the percentages of dead pups and increases. Either of these might form the basis of a census, especially in a year when harem counts for some reason are not made.

To analyze the values of these we must inquire into the causes of the conditions which are found. As shown in a preceding paragraph, page 102, the percentage of dead pups found on the rookeries was a fairly constant factor during the time when there was a large average harem. But with the increase in the number of bulls there has likewise been an increase in the number of dead pups found at the same seasons of different years. It is perfectly natural to record these as cause and effect. It is not disputed that 90 per cent of all dead pups found nowadays have been killed by the bulls fighting and charging over the breeding areas in the early part of the season. At the time of the count, however, few are in a fit state of preservation for autopsy. It is definitely known that some bulls kill more cows and pups than others do, and no law governs the return of these bulls to any particular rookery. The topography on some areas makes the death rate there higher than on others.

Therefore, while there is certainly a relation existing between the percentage of the dead pups to the total number of pups and the increase of bulls, it hardly seems necessary to resort to this method for census estimation, except in emergency. When the minimum average harem exists there is no doubt the percentage of dead pups from trampling is practically constant and the total number of pups could be arrived at very closely by the simple expedient of counting those dead after the breeding season. In future years it will be well to

bear this in mind, so that it can be made such use of as conditions may warrant.

The number of dead pups on those rookeries where they were not counted was arrived at in the same manner as the average harem; that is, the percentage of dead on the areas counted was compared with that of the herd in years past and a percentage assumed in 1917, which was in accordance with these facts. While the result can not be said to be known to be absolutely correct, it must be admitted that it can not be far from the actual conditions which existed. In tabular form the figures show as follows:

PERCENTAGES OF DEAD PUPS IN 1914, 1915, 1916, AND 1917 ON ROOKERIES ON WHICH THE DEAD PUPS WERE COUNTED IN 1917.

Rookery.	1917	1916	1915	1914
ST. PAUL ISLAND.				
Lukanin.....	2.72	4.01	1.43	3.9
Reef.....	2.62	1.12	1.65	1.5
Lagoon.....	1.07	.77	1.78	.5
Zapadni.....	2.65	1.51	2.19	1.6
Zapadni Reef.....	2.79	1.50	1.37	1.4
Polovina.....	3.35	2.38	1.73	1.9
Polovina Cliffs.....	3.06	1.18	.58	1.2
Little Polovina.....	1.19	1.39	1.13	1.8
Morjovi.....	3.08	1.59	1.58	1.8
Vostochni.....	4.67	3.70	2.75	2.5
Total.....	3.43	2.39	2.13	2.05
ST. GEORGE ISLAND.				
Zapadni.....	1.61	.82	1.11	.7
East Reef.....	1.34	1.07	.28	.8
Total.....	1.43	.98	.68	.81
Total, both islands.....	3.34	2.33	2.07	2.01

For the purposes in hand, the significant portions of this table are the totals, which, properly arranged, appear as follows:

	St. Paul Island.				St. George Island.				Both islands.			
	1917	1916	1915	1914	1917	1916	1915	1914	1917	1916	1915	1914
Percentage of dead pups on rookeries on which dead pups were counted in 1917.....	3.43	2.39	2.13	2.05	1.43	0.98	0.68	0.81	3.34	2.33	2.07	2.01
Total percentage of dead pups in herds.....	3.16	2.19	1.82	1.9	2.13	1.72	1.32	1.5	3.01	2.12	1.74	1.8

α From estimates.

It is thus seen that the percentage of all dead pups in 1917 must be less than 3.43 on St. Paul Island, more than 1.43 on St. George Island, and less than 3.34 for the entire herd. To produce this result, the figures given in the main table, page 103, have been used and seem very satisfactory for all requirements.

It might be believed by one little familiar with seal life that when a complete pup count is impracticable a few rookeries could be counted to get the annual increase, and by simply applying this factor to the entire herd a census would be arrived at. This, however, might give very misleading results with the rookeries as they



exist to-day. The increase on any particular rookery is solely dependent upon the number of cows coming there, and it is well recognized that no law governs their hauling out. Thus, the percentage of increase of pups (or cows) on almost all rookeries has been an exceedingly erratic figure during the past six years. For the present, therefore, this factor may be dismissed from census calculations as having little value. In the preceding tables wherever the number of pups or cows comes in it should be remembered that this figure was computed from the average harem and these other methods of computation were used only as a check.

#### METHOD OF ESTIMATING BACHELORS.

The bachelor seals 1 to 6 years old must be estimated, no count worthy of serious consideration being possible. The most practicable method of arriving at their numbers has been found to consist in starting with the number of births of any one year and deducting therefrom each year certain losses.

The known losses are those killed on land in the regular proceeding of the sealing industry. Thus, since the last census, August 10, 1916, there have been killed on both islands 7,291 males over 1 year of age. These 7,291 animals must be divided into their respective ages, because killing is not and can not be confined to a single age, and it would not be desirable if it could, because the trade calls for more than one size and grade of skin. As a basis of the division into the several ages there have been available some data on seals which were branded when pups in 1912 through the initiative of George A. Clark, of Stanford University. Some of these seals have been killed each year and carefully measured in body lengths. A critical study of these lengths discloses the fact that there is considerable overlapping of every age in this character, so that a representative mean of the typical seal of each age must be assumed. This has been done with great care.

The results show that a seal makes its year's growth almost entirely during the three months, August, September, and October; that is, a 3-year-old in the fall of the year has a skin about as large as a 4-year-old in the regular killing season. This fact should be borne in mind if in the future killings are limited to any particular ages. Any limit of age which may be specified is given in order to produce skins of a prescribed size, and these will not be produced if the same age limits obtain in the fall as in the spring. For instance, it has been customary during Government operation to order the killings confined to 3-year-olds. This meant that no skins smaller than those furnished by the mean summer 3-year-old were desired. Interpreted literally, then, all 2-year-olds in the fall were exempt even though they had the proper size skins. The scheme was, of course, faulty in this respect, that it prevented the killing of a size of animal until it should have run the chances of surviving a winter when death rates are very high. Of course the rational way to establish a quota is to specify the lengths of animals to be taken and pay no attention to age. Animals of known ages intergrade in every character known except osteological, so that ordinarily the age of a seal can not be determined until after it has been killed. The same objection applied to the limiting of killing to animals having skins of a specified weight. The weight of the skin of any live seal can be no

more accurately guessed than an unknown weight locked up inside of a container. But the length of the live animal can be estimated under any circumstances within 2 or 3 inches. This was demonstrated to the 1914 investigation committee by the writer, and a method of measuring was worked out which has steadily grown in popularity. The superiority of the method as a means of determining the size of skins being obtained over a guess at the age or the weight of the skins has been conclusively proved in three years' experience. By correlating the lengths with the ages of known branded animals an age relation to length has been established, and when the length of an animal is known it is also known whether it falls within the limits of length of the average seal of one age or the other.

A comprehensive study of the growth of fur seals is in preparation, but must necessarily proceed for several more years before being finished. The following standards, however, have been adopted from the studies already made as representing the lengths of average animals of each age thus far studied. It should be added that the limits are subject to change, as more data on growth of the animals are accumulated.

STANDARDS OF BODY LENGTH OF TYPICAL MALE SEALS.

Age.	Lengths of typical summer seals.	Lengths of typical fall seals.
	<i>Inches.</i>	<i>Inches.</i>
Yearlings.....	Up to 37.....	Up to 37.
2-year-olds.....	37 to 40.....	37 to 42.
3-year-olds.....	41 to 45.....	43 to 48.
4-year-olds.....	46 to 51.....	49 to 57.
5-year-olds.....	52 to 59.....	58 to ..
6-year-olds.....	60 and over.....	

These standards have been used in segregating the classes of the several ages of seals killed during the year ended August 10, 1917. The yearlings are somewhat indefinite because only three unquestionable animals of this age have ever been studied; and these were in the fall. They do not reach the islands in the summer in sufficient numbers to become well known. The limits beyond the summer 5-year-olds remain to be determined when the branded animals shall have grown older.

Arranged according to the above standards, the animals killed on both islands fall as follows, and the numbers have been deducted from the numbers of bachelors in each class in the estimates.

AGES OF SEALS KILLED ON THE PRIBILOF ISLANDS DURING THE YEAR ENDED AUG. 10, 1917.

Age.	Fall, 1916.			Summer, 1917.			Grand total.
	St. Paul.	St. George.	Total.	St. Paul.	St. George.	Total.	
Yearlings.....		1	1	5		5	6
2-year-olds.....	23	113	136	65	35	100	236
3-year-olds.....	447	339	786	1,708	1,857	3,565	4,351
4-year-olds.....	103	48	151	1,509	476	1,985	2,136
5-year-olds.....	2	1	3	445	18	463	466
6-year-olds and over.....				88	6	94	94
Total.....	575	502	1,077	3,820	2,392	6,212	7,289

In addition to the known loss which the herd of bachelors suffers at the hands of man there is in constant operation the great factor of natural mortality while the animals are away from the islands on their migrations. With cows this loss has been found to amount approximately to 50 per cent of all females during the first three years of their existence. No more reliable data are available to apply to the males, hence this deduction has been made. It is divided arbitrarily into 35 per cent the first year, 20 per cent the second, and 4 per cent the third. In this it is assumed both sexes are born in equal numbers.

There is natural mortality after the third year, but there are no means of knowing exactly or even with any approximation what it is but it must be a small percentage. It is believed allowances otherwise made are ample to more than offset it, hence no deductions have been made after the third year until the seals mature.

#### YEARLINGS.

The number of yearlings in the herd at the present time is ascertained from the number of pups born in 1916. This was 116,977. When the arbitrary number 40,941 based upon the assumption that the loss the first year is 35 per cent, is deducted there are left 76,036 to represent the males and females of this age in 1917. Half of these, or 38,018, should be of each sex, and this number is the best available for the females in 1917. Five males were killed as shown in the table on page 118, thus leaving 38,013. It seems an insignificant matter to deal with such small numbers when such large assumptions are involved, but it is believed that the more known factors which can be brought to bear in a problem dealing with unknown quantities the better the result will be. (It should be remembered by any person studying census computations that whereas exact figures are given whenever the calculations involved lead to them it is in reality intended that only the round numbers shall apply. The best which can be made is a careful estimate.)

There is little which can be added to the small amount of information already available about this group of seals. A male, however, was accidentally killed on St. Paul Island, August 10, 1917. Realizing the paucity of knowledge of the class, it was carefully measured and weighed and the skeleton was entirely preserved. Its importance seems to warrant a special study which has not been completed. It can be stated, however, that the animal was very fat, weighed 38 pounds and was 36 inches long. Its skin, removed in the usual commercial manner, weighed 7 pounds.

No difficulty need be experienced by anyone in recognizing the yearlings on the killing field or on the rookeries when it is remembered that the animals are no larger, and in most cases smaller, than the pups. But unlike the pups they have light gray throats and the older animals' coloration otherwise in most cases. Their heads have a puppish aspect, and like many animals the flippers (feet) grow large before the rest of the body. The lower canines are but little over half as large as those of the 2-year-olds.

## 2-YEAR-OLDS, MALE AND FEMALE.

The number of pups born in 1915 furnishes the basis for determining the number of this class at the present time; this was 103,527. The computations leading up to 1916 for this and subsequent classes have been published in previous reports of the Bureau of Fisheries and need not be repeated here. Thus there were computed 33,646 female yearlings in 1916, 20 per cent are supposed to have died the second winter, leaving 26,917 virgin cows in 1917.

There were estimated 33,645 yearlings males for 1916. One was killed in the fall which left 33,644. Deduct the 20 per cent for natural mortality and there remain 26,915 at the beginning at 1917. An even hundred were killed as 2-year-olds, which leaves 26,815 for the class on August 10, 1917.

## 3-YEAR-OLD MALES.

The number of 3-year-old males is derived from the births of 1914, or in other words, from the 2-year-olds in 1916. The latter figure was 24,169. Of these 136 were killed in the fall of 1916, leaving 24,033. Deduct 4 per cent for natural mortality and there remain 23,072 for the beginning of 1917. During the past summer (1917) 3,565 were killed, so that there should remain on August 10, 19,507.

The 3-year-old females bore pups for the first time in 1917 and are therefore included in the breeding-cow class.

## 4-YEAR-OLD MALES.

The number of 4-year-old males is derived from the number of births of 1913 or the 3-year-olds in 1916. The 3-year-olds in 1916 numbered 19,402. As explained heretofore no deductions need be made for natural mortality of bachelors after the third year. Therefore, we need only deduct the number of animals killed on land in the regular course of events. In the fall of 1916 and the summer of 1917 there were taken of the 3-year-olds and 4-year-olds, respectively, 786 and 1,985. Deduct these numbers and there remain 16,631.

## 5-YEAR-OLD MALES.

This category is derived from the pups born in 1912 or the 4-year-olds of 1916. The latter figure was 15,427. Deduct 151 4-year-olds killed in the fall of 1916, and 463 5-year-olds killed in the summer of 1917, and there remain 14,813.

## 6-YEAR-OLD MALES.

The number of 5-year-olds computed for 1916 was 15,494. Three were killed that fall leaving 15,491, and 94 6-year-olds, or over, were taken in the summer of 1917. Some of these were known to have been over 6 years old, but as the limits of this age are not yet defined and the number concerned is insignificant it may be deducted from the class. This leaves 15,397 to enter the surplus and idle-bull classes in 1918. After the age of 6 years is reached it is very probable that the

body lengths will express little if any age relations because of the variation in the sizes of bulls which are fully adult. That is, the curve is then becoming a straight line which continues through the rest of the seals' lives.

#### SURPLUS BULLS.

There were counted at the height of the breeding season 7,556 idle bulls and harem bulls. Now, the hauling grounds and rookery margins were filled with other bulls over 6 years of age, but which could not get close enough to the masses of cows to desire to hold positions. Some had been whipped and injured on the rookeries and had resorted to the hauling grounds to recuperate. They were all left uncounted. To complete the census, it becomes necessary to prepare an estimate of this class, because they are included in no other. Heretofore it has not been necessary to include such a category, because bulls were not then superabundant. They were nearly all about the rookeries, and the number left uncounted as idle bulls and harem bulls was insignificant. But this was not the case in 1917. They got in the drives to such an extent that they interfered considerably with sealing work. These surplus bulls were largely 7 and 8 year old animals, and may be best estimated by starting with the 6-year-old males of 1916.

The number of 6-year-old males in 1916 was 11,167. None was killed in the fall of 1916. In 1916 there was a total of 6,132 breeding males. When there is an abundance of bulls, and consequently much fighting, their breeding age is probably not over 8 years. It is not believed to be as long as the females, because the branded males of 1901, 1902, and 1903 have not been as much in evidence as the females. It may be even less than 8 years; no satisfactory means of determining this question is known. By assuming that it is 8 years makes it necessary to deduct  $12\frac{1}{2}$  per cent (766) from the 6,132 bulls of 1916 for loss due to old age. This leaves 5,366 of the 1916 bulls for 1917. This deducted from the total bulls of 1917 (7,556) makes an increment of 2,190 necessary on the rookeries, and they were derived in sufficient entirety from the 6-year-old class of 1916 to be taken from them. This leaves 8,977 of the 6-year-old animals of that year unable to get on the rookeries, and they are called surplus bulls. While it is known that not all of these were 7-year-olds which were hauled away from the rookeries, it is believed that there were enough of this class which did not get cows or became idle to offset the number of older bulls on the hauling grounds. And while this computation may appear somewhat indefinite, no better method has occurred by means of which the number may be arrived at more satisfactorily. Most certainly these bulls on the hauling ground can not be ignored and left unmentioned because they are difficult to estimate. It is believed that the figure given is conservative and under rather than over the actual number. This class will not continue longer than it takes to reduce the surplus of bulls now obtaining by commercial sealing.

## COMPLETE CENSUS OF FUR-SEAL HERD, 1917.

Pups, as per counts and estimate.....	128,024	
Breeding cows, 3 years old and over.....	128,024	
Harem bulls, as per counts.....	4,850	
Idle bulls, as per counts.....	2,706	
Yearlings, male and female:		
Pups born in 1916.....	116,977	
Deduct 35 per cent for natural mortality.....	40,941	
Yearlings beginning of 1917.....	76,036	
Females, 50 per cent.....	38,018	
Males beginning of 1917.....	38,018	38,018
Males killed in 1917.....	5	
Males Aug. 10, 1917.....		38,013
2-year-old male and female:		
Yearling females Aug. 10, 1916.....	33,646	
Deduct 20 per cent for natural mortality.....	6,729	
2-year-old females in 1917.....		26,917
Yearling males Aug. 10, 1916.....	33,645	
Males killed fall of 1916.....	1	
Males end of 1916.....	33,644	
Deduct 20 per cent for natural mortality.....	6,729	
2-year-old males beginning of 1917.....	26,915	
2-year-old males killed 1917.....	100	
2-year-old males Aug. 10, 1917.....		26,815
3-year-old males:		
2-year-old males Aug. 10, 1916.....	24,169	
2-year-old males killed fall of 1916.....	136	
2-year-old males end of 1916.....	24,033	
Deduct 4 per cent for natural mortality.....	961	
3-year-old males beginning of 1917.....	23,072	
3-year-old males killed in 1917.....	3,565	
3-year-old males Aug. 10, 1917.....		19,507
4-year-old males:		
3-year-old males Aug. 10, 1916.....	19,402	
3-year-old males killed fall of 1916.....	786	
3-year-old males end of 1916.....	18,616	
4-year-old males killed in 1917.....	1,985	
4-year-old males Aug. 10, 1917.....		16,631
5-year-old males:		
4-year-old males Aug. 10, 1916.....	15,427	
4-year-old males killed fall of 1916.....	151	
4-year-old males end of 1916.....	15,276	
5-year-old males killed in 1917.....	463	
5-year-old males Aug. 10, 1917.....		14,813
6-year-old males:		
5-year-old males Aug. 10, 1916.....	15,494	
5-year-old males killed fall of 1916.....	3	
5-year-old males end of 1916.....	15,491	
6-year-old males killed in 1917.....	94	
6-year-old males Aug. 10, 1917.....		15,397

## Surplus bulls:

Breeding bulls in 1916.....	6,132
Deduct 12½ per cent for old age loss.....	766

1916 bulls in 1917.....	5,366
Total bulls in 1917.....	7,556
Deduct 1916 bulls in lot.....	5,366

Increment of young bulls in 1917.....	2,190
6-year-old males in 1916.....	11,167
Deduct increment going into breeding bulls class, 1917.....	2,190

Surplus bulls Aug. 10, 1917.....	8,977
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## RECAPITULATION.

Pups.....	128,024
Breeding cows.....	128,024
Harem bulls.....	4,850
Idle bulls.....	2,706
Yearling females.....	38,018
Yearling males.....	38,013
2-year-old females.....	26,917
2-year-old males.....	26,815
3-year-old males.....	19,507
4-year-old males.....	16,631
5-year-old males.....	14,813
6-year-old males.....	15,397
Surplus bulls.....	8,977

Total, all seals.....	468,692
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# **MORTALITY OF FISHES ON THE WEST COAST OF FLORIDA**

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By **HARDEN F. TAYLOR**  
*Scientific Assistant, Bureau of Fisheries*

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**Appendix III to the Report of the U. S. Commissioner of Fisheries for 1917**



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# MORTALITY OF FISHES ON THE WEST COAST OF FLORIDA.

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By HARDEN F. TAYLOR, *Scientific Assistant, Bureau of Fisheries.*

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## OCCASION FOR THE INVESTIGATION.

Repeatedly in the past 75 years reports have come from the west coast of Florida of "poison water," which killed fishes in large numbers, and also, according to some reports, other animals, notably sponges. The reports and references are too fragmentary to give an accurate record of the distribution of the mortality, but collectively they clearly indicate that all the keys from Key West nearly as far north as Cedar Keys have been visited by this plague, and that it occurred in the years 1844, 1854, 1878, 1880, 1882, 1883, 1908, and finally in 1916.

## REPORTS OF THE DISASTER IN 1916.

In October and November, 1916, the mortality recurred in severe form, the first visitation since 1908. Numerous descriptive reports were received, from which the following significant points were summarized:

Fishes of a great number of species were noted dead and dying; the air was charged with a suffocating gas, which not only occasioned severe discomfort to man and other air-breathing animals, but irritated the air passages, producing the symptoms of colds. This gas, while exceedingly irritating, had no odor. The fishing smacks which are equipped with "wells" or openings through to the water in which live fish are kept report that the whole catch died while the smacks were en route to port; the normal color of the water had given way to water of different color, variously described as "black streaky," "amber," "olive," and "red"; the white paint of certain houses near the water was temporarily blackened, apparently by gases from the enormous number of dying fish. Some local observers found fish dying in the sounds; others noted them in the passes and in the Gulf to a distance of 45 miles out, but the abundance of fish in any locality varied from day to day. The reports of the order

in which the species appeared are not consistent, so it is assumed that there was no particular succession of species. The abnormal conditions seemed to be moving southward, occurring at Boca Grande on October 3 and 18, at Captiva Pass about the middle of October, at Blind Pass about October 20, at San Carlos Pass about November 1, and dead fish were first seen at Big Marco Pass on November 5. Captiva Pass is 7.5 statute miles south of Boca Grande Pass; the others are, respectively, 16.5, 27.75, and 67.75 miles to the south of Boca Grande Pass. The captain of the steamer *Roamer*, of the Florida Shellfish Commission, reports that dead fish were seen as far south as Cape Romano, about 128 miles south of Boca Grande. The death of two persons in Fort Myers, Fla., in November, was attributed to the eating of some of these dead fish.

The following letters from George H. Skermer, deputy collector of customs at Boca Grande, describing the phenomenon, merit reproduction here. Letter dated October 22, 1916, reads:

I wish to call your attention to an unusual phenomenon which has occurred on the Gulf coast during the past month, and which, so far as I am able to ascertain, has extended on the north to Sarasota and south to Naples, westward, from 15 to 20 miles.

About October 3, large quantities of what are locally known as "red-mouth grunts" began to come ashore. These fish were normal in appearance, with the exception that many showed a tendency to have the eyes almost forced out of their sockets. The early morning of the third the Gulf was covered with these fish as far as the eye could see. Later in the day many other varieties began to drift in, and by night what might be styled windrows of them were lying along the beach. Among them were many fish altogether strange to us; among the known varieties were mackerel, jacks, small shark, porkfish, sheeps-head, toadfish (several varieties), mangrove snappers, grouper, sardines, sea-horse, cowfish, remora, moray, eels, mullet, pinfish, gurnards, ladyfish, grunts, and many other varieties, not all of which showed the tendency to "popeye."

Soon after this drift commenced I went to the beach accompanied by a small dog; while on the beach I felt a slight tendency to sneeze and cough; shortly afterwards my attention was called to the action of the dog which was sneezing violently and seemed to be in acute distress, choking and showing every symptom of asphyxiation. I carried him off the beach and in a short time he seemed to recover, so I carried him back, and the same thing happened again. I then noticed that my lungs were feeling sore and that my breathing was labored, in much the same manner as when I board ships after fumigation, except that I could notice no odor. Other people were affected the same way.

Later in the day the captain of the Cuban fishing smack *Rafaela Pedre*, which had run into the harbor for water after a 45-day trip, come to the office and told me that his entire catch of grouper and snapper had died almost immediately after the tide started in. I questioned him carefully and found that they had noticed the peculiar sensation I have above described. The next day another smack came in with her fish dead and reported that dead fish covered the Gulf for miles out. The captain of the Dutch steamship *Zeta*, which arrived on the 8th, reported that he had passed through miles of dead fish.

In a few days the plague abated, very few more coming in.

However, on the 18th another violent outbreak occurred, this being much more serious than the first, inasmuch as it had killed many large fish which did not seem to be the case during the first attack. For the past few days the beach has been lined with tarpon, jewfish, grouper, and many varieties of top fish which seemed to escape the first attack. In addition to this, many of the bay fish are succumbing. The gas was very violent this time and many people telephoned for medical assistance for "cold in the head," "sore throats," "cold in the chest," etc., besides coming to see the local physician, who is also the United States quarantine surgeon here. I, myself, have suffered quite acutely for the past five days, but the worst of the gas seems to be going now.

I tried the dog again, and again had to take him off. I do not think he would have been able to live over two hours on the beach. The fish died in a very short time. I observed a mullet dying yesterday; as the tide came into the bayou the gas met him, he began to act strangely, coming to the top, whirling around and around, and then sank to the bottom, lying stomach up for a little while, when he turned on his side dead. Spadefish acted the same way. It is now reported that the fish are dying freely in the remote bays and bayous, every local variety seeming to give up its share. I have been told that many of the barnacles have also died, but I can not confirm this. I have noticed that the conchs and crabs are not dying, at least to any extent. \* \* \*

If you desire any other information as to this matter, I shall be glad to furnish it if it lies in my power. I meant to state that I noticed the pungent feeling of the gas particularly when a wave "broke" and believe that this will explain why the top fish escaped with less visible destruction than the bottom, the breaking of the wave aerating the water more or less. \* \* \*

The gas has none of the characteristics of  $H_2S$ ; it acts with the same peculiarity of chlorine, but is odorless, perhaps is  $CO_2$ ; addition of lead acetate to sea water gives a dense white precipitate, but am not sure but that it might do that normally, precipitating lead chloride.

The "odorless but exceedingly irritating gas," as described, was not noted by the observer, but had, perhaps, already subsided. The protrusion of the eyeballs was due to the accumulation of gases from decay behind the orbits, as only those fishes which had been dead for some time were thus affected.

A letter from Mr. Skermer, dated November 11, 1916, reads:

I am in receipt of your letter of the 8th instant relative to the supposed presence in the Gulf waters of *Peridinium* in abnormal numbers. I wish to state that I have not been able to learn of such conditions obtaining nor have I noticed any marine growth of abnormal appearance at any time during the mortality periods. However, I have inquired carefully at every opportunity since the fish began to die from any person who I had reason to suppose had come in contact with the dying fish as to whether he had noticed any peculiarity in the water. I learned from two persons that the fish seemed to die in "streaks" and sometimes in dark-colored water; others noticed nothing abnormal in the appearance of the water but did speak of the odorless but exceedingly irritating gas which seemed to be liberated at intervals. \* \* \*

This morning I inquired of a Spanish fisherman, who lives about 7 miles south of Boca Grande, as to conditions near him. He informed me that fish were still dying along the Captiva Pass and inside waters of Pine Island Sound. He further stated that the fish died when coming in contact with it. The dark-colored water he said was in the bays and did not enter the Gulf at all except at low water. From this I am inclined to believe that it is

simply an overflow of swamp water, and do not believe that it is the cause of the mortality.

The fish were killed many miles out in the Gulf. The captain of the Dutch steamer *Themisto*, which arrived here October 27, told me that he passed through immense numbers of dead fish 45 miles out. I asked him if he noticed anything abnormal in the appearance of the water, and he said "No." A fishing smack which entered here lost all its fish after entering the bay, and another reported that upon attempting to enter the bay saw its fish beginning to die, and that upon turning about and going into the Gulf they recovered. I can only reconcile the two circumstances in this way: For several days after the fish ceased dying in the Gulf they died in the bay, and it is probable that the last-mentioned smack met the returning current from the bay to the Gulf, while the first-mentioned got it in full strength from the Gulf in the beginning of the attack, as he was anchored in the tidal channel.

\* \* \*

### INVESTIGATION IN THE FIELD.

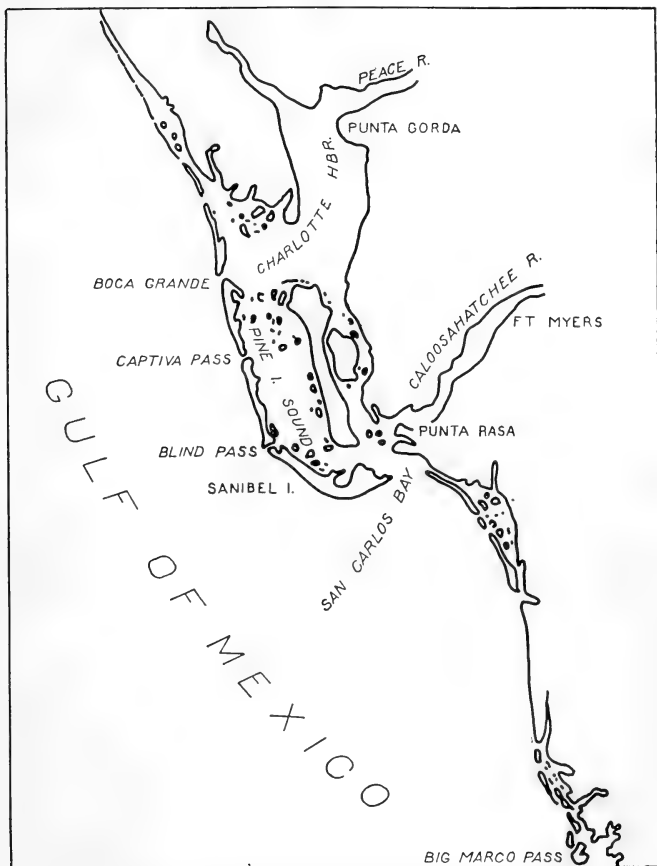
Conditions made it impossible to undertake a field investigation during the early stages of the mortality when it was at its worst, but the writer arrived at Fort Myers, Fla., on the Caloosahatchee River, November 12, and remained in the region for a period of 10 days.

Since the mortality of the fishes had been ascribed to foul water from the Everglades, the condition of this river was first noted. No abnormal conditions were observed in the river; small fish were abundant; birds were feeding upon them. Schools of mullet and red drum ("redfish"), vast numbers of ducks, and many pelicans were seen on the river below Fort Myers. In no case was a dead water animal found on the river. The water was of a brownish color, due, presumably, to tannin or other pigments from the mangroves and palmettoes, but it is understood that such a condition is not unfavorable to fish.

On the next day a reconnaissance trip was made on a river steamer from Fort Myers down the Caloosahatchee to Punta Rasa, thence across San Carlos Bay to Sanibel, across the bay again to St. James City, on Pine Island, thence across Pine Island Sound to Wulfert (inside mouth of Blind Pass), then through a narrow channel to Captiva, returning the same day via Sanibel and Punta Rasa. Between Fort Myers and Punta Rasa (18 miles) the river appeared to be normal in every respect. In San Carlos Bay dead fishes were noted, blanched and soft, apparently having been dead for some time. On the inside beaches of Sanibel, Pine, and Captiva Islands dead fishes in great numbers and of a multitude of species were noted, all in a state of decay.

On the return trip, near Sanibel Wharf, a specimen of squeteague (*Cynoscion nebulosus*) was taken in a state of rigor mortis, but without apparent abnormality.





MAP SHOWING REGION WHERE MORTALITY OCCURRED.



SAN CARLOS BEACH, SANIBEL ISLAND, NOVEMBER 19, 1916.



GULF BEACH, SANIBEL ISLAND, NOVEMBER 19, 1916.

Beginning the next day, November 13, the writer spent three days in the vicinity of San Carlos Bay, with headquarters at Sanibel. In this interval water samples were collected at various places in San Carlos Bay and Pass, Pine Island Sound, Tarpon Bay, and Blind Pass. Efforts made to collect bottom samples were successful only in obtaining pieces of shell and fragments of a thin layer of lime deposit which seems to cover the bottom in San Carlos Bay and Pine Island Sound. Such qualitative tests as were made indicated a rather strong alkalinity. On November 13 and 14 dead fishes were in greater abundance, coming in, apparently, on the tide. On the 13th a census of dead fishes was taken covering 20 steps of the San Carlos Beach, Sanibel Island. This census revealed 163 specimens of fishes, of 26 species, and included neither the windrow cast up at high tide, nor those floating, but only those at or close to the water's edge. On the dark nights of that week the phosphorescence of the decaying fishes made the beach visible for a long distance, and the sand was so charged with phosphorescent bacteria that one's tracks persisted for some seconds. Familiar fishes were identified by their own light. The odor was almost intolerable; people dwelling on the islands hauled away wagonloads and buried them in their orchards for fertilizer.

## SPECIES AFFECTED.

In all the region covered the following species were noted:<sup>a</sup>

Species.	Common name.	Family.
<i>Manta birostris</i> b	Devilfish	Mantidae.
<i>Ocyurus chrysurus</i> b	Yellow-tail	Lutianidae.
<i>Neomænis griseus</i>	Mangrove snapper	Do.
<i>Epinephilus morio</i> b	Red grouper	Serranidae.
<i>E. striatus</i>	Nassau grouper	Do.
<i>Garrupa nigrita</i>	Jewfish	Do.
<i>Centropristis striatus</i>	Sea bass	Do.
<i>Menticirrhus</i> sp. b	Whiting	Scienidae.
<i>Cynoscion nebulosus</i>	Spotted squeteague ("trout")	Do.
<i>C. sp.</i>	Squeteague ("trout")	Do.
<i>Bairdiella</i> sp.	Sand perch	Do.
<i>Pogonias cromis</i>	Black drum ("drum")	Do.
<i>Sciaenops ocellatus</i>	Red drum, channel bass ("redfish")	Do.
<i>Tarpon atlanticus</i> b	Tarpon	Elopidae.
<i>Caranx hippos</i>	Crevalle	Carangidae.
<i>Caranx crysos</i>	Crevalle ("skip jack")	Do.
<i>Selene vomer</i>	Moonfish	Do.
<i>Trachinotus carolinus</i>	Pompano	Do.
<i>Oligoplites saurus</i>	Leather jacket	Do.
<i>Scorpena</i> sp.	Scorpionfish	Scorpenidae.
<i>Mugil cephalus</i>	Mullet	Mugilidae.
<i>Hæmulon plumieri</i>	Grunt	Hæmulidae.
<i>H. sciurus</i>	do	Do.
<i>Bathystoma rimator</i>	Red-mouth grunt	Do.
<i>Anisotremus virginicus</i>	Porkfish	Do.
<i>Monacanthus</i> sp.	Filefish	Monacanthidae.
Do.	do	Do.
<i>Scomberomorus regalis</i>	Cero; kingfish	Scombridae.
<i>Rissola marginata</i>	Cusk eel	Ophidiidae.
<i>Scarus vetula</i>	Parrotfish	Scaridae.

<sup>a</sup> The identifications here represented are, of course, open to question. Time did not admit of careful study. On the great majority of the fishes the colors had faded, of several species only badly decomposed specimens were seen, and some of the others were quite unfamiliar to the observer.

<sup>b</sup> Not seen by writer, but reported by fishermen and others.

Species.	Common name.	Family.
<i>Chaetodipterus faber</i> .....	Spadefish.....	Ephippidae.
<i>Archosargus probatocephalus</i> .....	Sheepshead.....	Sparidae.
<i>Otrynter caprinus</i> .....	Long-spine porgy.....	Do.
<i>Calamus</i> sp.....	Porgy.....	Do.
<i>Lycodontis (moringa?)</i> .....	Black moray.....	Muraenidae.
<i>L. (jordani?)</i> .....	Spotted moray.....	Do.
<i>Paralichthys</i> sp.....	Flounder.....	Pleuronectidae.
<i>Echeneis remora</i> .....	Remora, shark pilot.....	Echeneidae.
<i>Clupanodon pseudohispanicus</i> .....	Sardine ("shiner").....	Clupeidae.
<i>Brevoortia tyrannus</i> .....	Menhaden.....	Do.
<i>Chaetodon ocellatus</i> .....	Butterflyfish.....	Chaetodontidae.
<i>Angelichthys ciliaris</i> .....	Angelfish.....	Do.
<i>Lactophrys tricornis</i> .....	Trunkfish ("cowfish").....	Ostraciidae.
<i>Lactophrys trigonus</i> .....	Trunkfish.....	Do.
<i>Lionotus</i> sp.....	Sea robin.....	Triptilidae.
<i>Opsanus</i> sp.....	Toadfish.....	Batrachoididae.
<i>Spheroides</i> sp.....	Puffer ("toadfish").....	Tetraodontidae.
<i>Chilomycterus spinosus</i> .....	Burr fish.....	Diodontidae.
<i>Dasyatis</i> (say?).....	Sting ray.....	Dasyatidae.
<i>Raja</i> sp.....	Skate.....	Rajidae.
<i>Etobatus narinari</i> .....	Spotted sting ray.....	Myliobatidae.
<i>Rhinobatus lentiginosus</i> .....	Guitar fish.....	Rhinobatidae.
<i>Felichthys felis</i> .....	Gulf-topail catfish.....	Siluridae.
<i>Galeichthys (milberti?)</i> .....	Sea catfish.....	Do.
<i>Hemirhamphus</i> sp.....	Halfbeak; needlefish.....	Hemirhamphidae.
<i>Tylosurus</i> sp.....	Marine gar; needlefish.....	Belonidae.
<i>Leptocephalus coner</i> .....	Small eel; whip eel.....	Moringuidae?
<i>Synodus foetens</i> .....	Conger eel.....	Leptocephalidae.
<i>Sphyrna tiburo</i> .....	Lizard fish.....	Synodontidae.
<i>Carcharinus (obscurus?)</i> .....	Shovel-nose shark.....	Sphyrnidae.
<i>Albula vulpes</i> .....	Shark.....	Galeidae.
<i>Ogcocephalus vespertilio</i> .....	Ladyfish.....	Albulidae.
	Batfish.....	Ogcocephalidae.

Of invertebrates, sea urchins (*Arbacia*), the king, or horseshoe crab (*Limulus*), and sponges were noted. It is a matter worth noting that very few animals other than fishes were killed. Barnacles, oysters, and mussels were examined, but they were in good condition. Live conchs and hermit crabs were repeatedly observed. Porpoises were plentiful during the period of observation. Pelicans and other water birds behaved normally. Buzzards were common in the locality, yet they neglected the dead fish entirely.

The dead fauna of the Gulf beach was not markedly different from that of the bays. Relatively more carangids, sharks, and rays were seen, but many of the dead forms were buried in the hard beach sand, hence the Gulf beach did not present such a striking picture as did the inside beaches. Taking the whole territory into consideration the relative abundance of the different species is estimated as follows in the order given, less abundant species being omitted:

Grunt (*Hæmulon plumieri*) (*H. sciurus*).

Mullet (*Mugil cephalus*).

Trunkfish (*Lactophrys trigonus*) (*L. tricornis*).

Puffer (*Spheroides* sp.).

Menhaden (*Brevoortia tyrannus*).

Sardine (*Clupanodon pseudohispanicus*).

Red-mouth grunt (*Bathystoma rimator*).

Spadefish (*Chaetodipterus faber*).

Moray (*Lycodontis* sp.).

Filefish (*Monacanthus* ?).

Sheepshead (*Archosargus probatocephalus*).

Spotted squeteague (*Cynoscion nebulosus*).

It is assumed that the numbers are representative of the relative abundance of these forms in life. The sizes of specimens would also suggest that all true fishes were killed, regardless of size. They range from jewfish of approximately 200 pounds to forms less than  $\frac{1}{2}$  inches long.

#### METEOROLOGICAL CONDITIONS.

The temperature of the water was around 75° F. until November 15. On this date a violent "northwester" blew up, occasioning a series of extraordinarily high and low tides. After this the temperature was 65° F., and continued at about that figure through the remainder of the observation period. Contrary to what might be expected, the mortality of fishes did not cease after the storm. In this connection it may be added that the wind had been blowing constantly from the northeast for several weeks previously and, after the storm, shifted around to the northeast again.

The water was olivaceous in color—about such a color as would be expected from a mixture of sea water with the brownish water of the rivers. Those accustomed to seeing the water stated that during the period of mortality the water was of a more brownish color than usual. The wake of the boats had an oily appearance, or was apparently not so effervescent as that in normal sea water. It was further stated that at the height of the mortality, on the Gulf coast, the water was of an amber color (by transmitted light). This colored water was described as being not uniformly distributed, but occurring in streaks, and it was in these streaks that the fish are said to have perished. A resident of the island described the death of a mullet thus:

The fisherman was following a large mullet in Tarpon Bay (partly inclosed in Sanibel Island), intending to capture it with a cast net. The fish, at a depth of possibly 2 feet, seemed suddenly to strike a streak of the bad water, came rapidly to the surface, flipped from the water, and, after a short struggle, expired.

The exact spot, about 6 feet from shore, was visited by the observer, but nothing unusual was noted. Several dead mullets were seen ashore; live porpoises and conchs were in the water.

#### EXAMINATION OF SPECIMENS.

On November 16 a mangrove snapper (*Neomænis griseus*) was taken by a boatman in a moribund condition. The writer first saw this fish a few minutes after it had died, and he at once dissected it. The blood was not yet coagulated, and, indeed, seemed less inclined to coagulate than one might expect. The fish was not infested with parasites, no lesions were noted, the gills were pink (perhaps too red), the stomach contents were small fish, clean and constituting an

apparently wholesome food. The liver was slightly abnormal in appearance, being faintly mottled with a lighter shade of brown. The mucous covering of the body was transparent and colorless; none of the organs were distended by gas, nor were gas bubbles observed in the blood vessels. The eyes were clear, and no evidence of fungus was seen. The coloring of the fish was vigorous.

Fishes in a moribund condition were reported as having been observed in the passes, in the Gulf, and in Tarpon Bay, but since the carcasses drifted with wind and tide the mere presence of dead fish was not an indication of a mortality at any given place. The condition sought for must have been immediately at hand, however, when a moribund fish was observed on November 19.

It was a small filefish (*Monacanthus* sp.), and was first observed near the dock at Bailey's Wharf, Sanibel, in water not over 3 feet deep. The fish was brilliantly mottled with maroon on a slate-colored background. It was drifting upon its side, making but slight effort to balance. This fish was captured and placed in a bucket of the water from which the fish was taken. A moment later a small, active, pinfish was captured in the same place and likewise kept in another bucket with some of the same water. The color of the filefish faded, but repeatedly revived when the fish was disturbed; each response, however, was weaker than the preceding one until the fish died, and the color faded in about 2 hours. The pinfish, taken at the same time and place, lived till it was released at Fort Myers, about 6 hours later. Both species had repeatedly been noted dead upon the beach. Within 50 feet of the point where the filefish was dying numerous mangrove-snappers and sheepshead were seen, quite healthy in appearance. So we have the anomalous condition of dying fish and perfectly healthy fish within 50 feet of each other and in the same water, with certain knowledge that all the species concerned are subject to destruction by the abnormality responsible for the death of so many species.

Representations were made to the writer concerning the pollution of Peace River. This is a small sluggish stream, tributary to Charlotte Harbor, and drains a region now being worked for phosphate rock. It was said that the waste from the works destroyed the fish. However true this may be, a brief visit only was necessary to show that such a pollution could have no bearing on the mortality under consideration. Small fish as well as vegetation were in the stream; and, besides, the stream is of insignificant size.

#### DISCUSSION OF POSSIBLE CAUSES OF THIS AND SIMILAR DISASTERS IN OTHER PARTS OF THE WORLD.

It may be said at the beginning of this discussion that while a definite conclusion has not been reached as to the cause or causes of this



VIEWS OF SAN CARLOS BEACH, SANIBEL ISLAND, NOVEMBER 19, 1916.



VIEWS OF SAN CARLOS BEACH, SANIBEL ISLAND, NOVEMBER 19, 1916.



mortality, yet certain possible causes are shown not to be operative. Furthermore, significant circumstances in the case of 1916 and of previous years, records of similar disasters in other parts of the world, and opinions of representatives of the numerous sciences concerned, are brought together here as the basis of discussion and also for further work, if there should be a recurrence of the phenomenon.

The mortality occurred in 1844, 1854 (Ingersoll, 1882), and a very severe attack was reported in January, 1878. In August, September, October, and November, 1880, it occurred again, but in relatively milder form. The last two instances are said to have been preceded by earthquakes. In July, 1882, the plague returned; in this case it may be connected with the tilefish disaster, which occurred at the edge of the continental shelf south of Nantucket along the 100-fathom line. In the summer of 1908 a similar mortality destroyed the sponge beds along the keys between Key West and the mainland. In 1916, as above stated, the mortality was exceedingly severe between Boca Grande Pass and Big Marco Pass. The older reports are meager and not based on direct observations; in some cases invertebrates—chiefly sponges and king crabs—were predominant, in others, sharks and porpoises. It may, then, be assumed that the reports furnish no reliable indication of exact conditions.

The causes suggested are (1) water from the Everglades charged with tannin and products of decomposition of palmettoes and mangroves; (2) extraordinary abundance of *Peridinium* known to have occasioned the death of fishes in different parts of the world; (3) a disease, fungoid, parasitic, or bacterial; (4) dilution of the water by unusually heavy rains; (5) an issue of gas, volcanic or natural; and (6) earthquakes or seaquakes.

#### FOUL WATER FROM THE EVERGLADES.

1. A hypothesis that has been advanced repeatedly is that water from the Everglades, charged with tannin and the products of decay in vegetation, is brought down by the rivers and kills fishes. It may be said with sufficient certainty that this is an impossible explanation. For there are no a priori grounds for assuming that the Everglade water is poisonous; nor is there any material evidence of such a condition. No fresh-water fishes were killed; life in the river was normal; and fishes are known to live in the Everglades. The sporadic appearance of the phenomenon casts doubt on the possibility of such an explanation. And, finally, it seems quite impossible to believe that the volumes of the rivers are sufficient to account for such a widespread distribution of the mortality. It may be, however, that the accumulation of the river load as a decaying organic sediment

furnishes the gases and other products of decomposition confined for a time, but sporadically released by what may be found to be the proximate cause—seismic disturbances. This possibility will be discussed later.

#### PERIDINIUM AND OTHER PROTISTS.

2. An extraordinary abundance of *Peridinium* has, at times, caused the death of a great number of fish and crustacea. Under certain circumstances, as yet unknown, these organisms multiply in vast numbers, giving the sea a reddish or chocolate color. Such colored areas are usually accompanied by an offensive smell, and are sharply marked off from the unaffected water. They have been encountered by mariners in many parts of the world, and numerous accounts appear in the literature. Darwin (1846) observed it “a degree south of Valparaiso,” Nishikawa (1901) and Mitsukuri (1904) on the Japan coast, Carter (1858) around the island of Bombay, Mead (1898) in Narragansett Bay, Smith (1903) in Manila Bay. Both Darwin and Carter cite numerous other references.

Dr. R. E. Coker records (in unpublished notes) from the coast of Peru a phenomenon possibly due to the same cause and commonly known as the “painter.” This phenomenon has been described by Hutchinson (1873) thus:

\* \* \* There is an interesting peculiarity here \* \* \* called the “painter,” the palpable evidences of which consist in a changed color of the sea water (most generally to a muddy white), an odor most fetid, nauseous, and depressing, with the accompaniment of the white paint on ships and boats, inside as well as outside, becoming totally discolored and often partially black. \* \* \* I am induced to attribute this emanation chiefly to submarine volcanic action, generating sulphuretted hydrogen gas. \* \* \* Although met with at Callao, in its most aggravated form, the “painter” is likewise found along the coast as far as San Jose de Lambayeque, nearly 500 miles north. From the end of December until April is the time when the phenomenon mostly exists.

I have before me an analysis of the sea water of Callao, bottled up during the existence of the “painter” and having some mud from the bottom of the bay contained therein. This was sent \* \* \* to London, and was there analyzed by Mr. T. Keates. Mr. Keates reports that, after being allowed to rest, the water poured off proved to be sea water and that the black mud left, after the water had been decanted, was in a state of active decomposition, large quantities of sulphuretted hydrogen gas as well as sulphate [sic] of ammonia being given off. The black color of the mud was found to be owing to the presence of sulphate [sic] of iron which was formed as a result of the decomposition mentioned. Whilst this latter was due to the sulphur of the organic matter combining with the iron present in the mineral part of the mud, to produce the black sulphide [sic] \* \* \*.

1 000 parts of the mud dried at 230° F. yields:

Water.....	769. 6
Dry mud.....	230. 4

100 parts of the mud dried yielding by analysis:

Organic matter-----	10.50
Chloride of sodium, alkaline sulphates, etc-----	6.43
Salts of lime-----	3.75
Alumina of [and?] oxide of iron [sic]-----	16.00
Siliceous matter-----	63.25
Loss-----	.07

\* \* \* In the course of a few days I observed the water of the bay under four different aspects.

First. Ochre-brown, with somewhat of a reddish tinge, and opaque. This, when examined under the microscope, showed animalculæ of a spheroid or circular form and of like color to the water. In 12 hours after it was—

Second. Of a dark green, and still thick aspect, in which, by the microscope, was visible another class of animalculæ of an hourglass form, round and broad at each end, but contracted at the center. Although there was but one drop of the water under the glass, a large number of these jumped about.

Third. The next morning, or in 14 to 16 hours afterwards, the water was a muddyish white. This time the smell in the harbor was most pungently nauseating. It is considered the true "painter" when white paint becomes black, and headaches are general, with everybody under its influence. No animalculæ were visible through the microscope in this state of affairs from the second to the third condition. I may add that in the intervening period we had a shock of earthquake at about 5 o'clock in the morning, and during the occurrence of which it may be conjectured submarine volcanic action destroyed all animal life of these insects seen two days previously.

Fourth. This is the ordinary water of Callao Bay. \* \* \*

From Hutchinson's description it would appear doubtful that this was *Peridinium*. Darwin's observations (1846) may help to clear this up:

On the coast of Chile, a few leagues north of Concepcion, the *Beagle* one day passed through great bands of muddy water exactly like that of a swollen river; and again, a degree south of Valparaiso, when 50 miles from land, the same appearance was still more extensive. Some of the water placed in a glass was of a pale reddish tint and, examined under a microscope, was seen to swarm with minute animalculæ darting about and often exploding. Their shape is oval and contracted in the middle by a ring of vibrating curved ciliæ. It was, however, very difficult to examine them with care, for almost the instant motion ceased, even while crossing the field of vision, their bodies burst. Sometimes both ends would burst at once, sometimes only one, and a quantity of coarse, brownish granular matter was ejected. The animal an instant before bursting expanded to half again its natural size, and the explosion took place about 15 seconds after the rapid progressive motion had ceased; in a few cases it was preceded for a short interval by a rotatory movement on the longer axis. About two minutes after any number were isolated in a drop of water they thus perished.

This may explain the ephemeral nature of the animalculæ, and also, since they die in such vast numbers, it is not difficult to conceive the consequences of the decay of so much organic matter.

Carter (1858) shows that the various hues of sea water, as described, are due, at least around the Island of Bombay, to one organism, *Peridinium sanguineum*. In the swimming stage the organism is green

and translucent; as the transition time approaches, the chlorophyll-like substance responsible for the green color disappears, a red substance takes its place and dissolves in oil globules that have been forming. At this stage it is red and visible to the naked eye. After only a few days the individuals assemble, lose their red color, become encapsulated (*Protococcus* form), and sink or float on the surface. This stage is followed by a subdivision into two or four new ones. This latter process may be repeated several times until eventually a ciliated form appears again, completing the life cycle. The latter form is covered by an excessively fragile shell which "is broken by the pressure of the thinnest piece of glass."

This description explains the varying color of the streaks, the periodicity, and it may explain the bursting observed by Darwin, if he used cover glasses in observing them.

Could this have been the cause of the trouble in Florida? No evidence of the presence, in extraordinary numbers, of these organisms was found. When the water was described as red, further questioning brought out the fact that it was by transmitted light on the beach, and not by reflected light. Fishes observed while dying were in clear water. Still, the condition as described may have existed before the writer arrived, and the dissolved decomposition gases might have persisted in the water to an extent fatal to fishes after the organisms responsible had perished. Or the organisms might have become lost from view either by disintegration or by passing into the *protococcus* form and sinking, as suggested by Carter (1858). But such red water, to explain the conditions found, would have to be distributed over an unprecedentedly large area to persist for two months and yet escape detection by the many passing ships, and it would be necessary to explain the widely fluctuating periodicity, in some cases one year, in two other cases 24 and 25 years, respectively.

Gilchrist (1914) definitely ascribes certain instances of mortality on the South African coast to *Noctiluca* and to diatoms. These forms, decaying in large numbers in the water, make the latter an unfit medium for fishes. Among the instances described by him as due to obscure causes, one is clearly due to *Peridinium*.

#### DISEASE AND PARASITES.

3. Evidence of disease or parasitism is likewise lacking, as is shown by the examination and dissection of specimens already described. On the other hand, it would be difficult to believe, without the most thoroughly convincing evidence, that so many species of animals could be affected by an epidemic of any single disease, or that such

a disease would confine itself to a limited locality for the larger part of a century or perhaps a much longer period of unrecorded observation.

#### DILUTION OF THE WATER.

4. Dilution of the water hardly deserves serious consideration, for the phenomenon is not correlated with the rainy season or unusual discharge of the rivers. As shown by the table, the salinity does not indicate serious dilution of the water. Of course a dilution adequate to explain the mortality of fishes would concern only an excess of run-off above the normal. The area of ocean concerned, in comparison with the small rivers, at once negatives this hypothesis; and if the water were sufficiently diluted, it may be assumed with good reason that unconfined fishes would seek their proper salinity by migration.

#### VOLCANIC AND NATURAL GASES.

5. It is now time to call particular attention to certain circumstances of prime importance that have served largely to destroy the foregoing suggested causes, and which can not be overlooked in arriving at a conclusion. They are (*a*) the irregular periodicity, both as to years and seasons; (*b*) the strictly marine aspect of the phenomenon; (*c*) the large area covered; (*d*) the definite limitation of this locality; (*e*) the limitation of the mortality to the animals, whose respiration is performed by an oxygen carrier, hæmoglobin, hæmocyanin, etc.; (*f*) the progressive southward appearance of the mortality.

The irregular periodicity, the marine aspect, the area covered, and particularly the limitation to the region concerned all suggest a geological explanation, whether the issue of a gas or the occurrence of an earthquake, fixed in one place, sporadic in outbreak, and independent of weather fluctuations. The species affected and the southward progress are not contradictory to such an explanation, as will be seen.

Dr. T. W. Vaughan, of the United States Geological Survey, stated verbally to the writer that he saw only the remotest possibility of a volcanic gas in this region. The region is inactive volcanically, and the discovery of a volcanic fumarole would occasion great surprise to geologists. Beyond that we have nothing for or against volcanoes. There is no question that volcanic gases would be deadly to fishes. For, while volcanoes emit different gases in different stages of their activity, the emissions always contain substances deadly to fishes, if nothing worse than carbon dioxide. It is scarcely necessary to present data here as to the composition of such gases. Any chlo-

rine, as hydrochloric acid or as ammonium chloride, or in any soluble combination whatever, would certainly be detected by the chlorine determination (salinity); sulphur gases and carbon dioxide would alter the alkalinity of the water, though much would depend on the freshness of the water when the determinations were made. An unfortunate delay impaired the value of the samples collected; it was therefore impossible to determine whether or not these gases were present.

Similar remarks concerning natural gas issues may be made. Such gases consist, of course, largely of the light paraffins, usually small quantities of olefines and occasionally some carbon monoxide. Little is known of the effects of these gases on fish. The injury to man done by methane is done chiefly or entirely by the mere dilution of the air by this gas. Ethylene and ethane probably act in a similar manner. These gases are slightly soluble in water, ethylene to the extent of 4 per cent volume. In water these gases could not act as they do in air, for the solubility of a gas is quite independent of all other gases and as much oxygen would be present in a saturated solution of any of them as in their total absence.

Of carbon monoxide more can be said. This gas acts as a poison to animals, whose respiration is dependent on a blood pigment by combining firmly with the pigment to the exclusion of oxygen; while these animals situated in the presence of abundant oxygen and presenting a wide area of "semipermeable" skin, and whose respiration is performed by the agency of oxygen dissolved in the blood plasma, are immune, since carbon monoxide does not interfere with the passage of oxygen into the body (Leitch, 1916). Carbon monoxide is soluble to a sufficient extent thus to interfere with respiration. It is therefore suggestive to note that all the animals killed, except sponges, were dependent on a blood pigment (hæmoglobin, hæmocyanin, echinochrom, etc.). Sponges are the only animals observed on the beaches whose respiration is not dependent on one of these carriers or pigments, but sponges are often seen, even in normal times on the beaches.

In February and March, 1894, the *Albatross* investigated and reported on a case of widespread mortality of fishes off the coast of California between Santa Barbara and San Diego. Evidences there obtained indicated petroleum and hydrocarbon gases as the cause of the disaster. Many species were killed, but those dead were chiefly flatfish and barracuda. The odor of petroleum was evident from the dead fish. The body slime was colored yellow in patches, and the gall bladder was ruptured. The oil springs said to exist off the coast were held responsible for the oil and gas issues.

## EARTHQUAKES.

6. Earthquakes kill fishes directly by concussion. Oldham (1899) cites the case of the destruction of fishes in the Sumesari River in India by the great earthquake of June 12, 1897, which killed "myriads as by the explosion of a dynamite cartridge." Numerous other instances are cited by various authors.

It is not evident in this case from the data at hand that earthquakes killed the fishes directly by concussion. The following extract from a letter from the United States Weather Bureau bears on this point:

Our records show that during 1916 there were no seismic disturbances of any considerable severity in the Gulf region.

We have no precise earthquake records of that region for the earlier dates, 1844 \* \* \* 1908, but probably no severe ones occurred, as this is not an active seismic region.

Further than this, the long duration of the mortality, the southward progress, and particularly the death of fishes under observation in the partly inclosed shallow water, entirely dismisses the hypothesis of direct injury by shock.

It seems possible, however, that the incidental effects of earthquakes might explain the death of the fishes. For instance, gases are sometimes emitted along with the shock. The following quotation from Darwin pertains to this aspect of the subject:

In Capt. Fitz Roy's excellent account of the earthquake (Chile, 1833, Jan. 20), it is said that two explosions, one like a column of smoke and another like the blowing of a great whale, were seen in the bay. The water also appeared everywhere to be boiling; and it became black and exhaled a most disagreeable sulphurous smell. These latter circumstances were observed in the Bay of Valparaiso during the earthquake of 1822; they may, I think, be accounted for by the disturbance of the mud at the bottom of the sea containing organic matter in decay. In the Bay of Callao during a calm day I noticed that as the ship dragged her cable over the bottom its course was marked by a line of bubbles.

Prof. J. B. Woodworth, of the Harvard seismographic station, sets forth, in a letter of some length, a possibility which has not been considered, and which seems worth investigating. The substance of his letter is as follows:

Previous to the cases of 1908 and 1916 there are no satisfactory records of seismic activity in the region concerned. It may be quite possible, however, that unobserved shocks of low intensity could explain the mortality; that occluded gases, resulting from the decay of sedimentary organic matter, are released by a disturbance of the sediment, under which circumstances the occluded gases would rise into the water, dissolve, and interfere with the life processes of fishes. Or, at the edge of the rather wide continental shelf in this region, a

seismic disturbance of low intensity might cause accumulated sediments to slide off into abyssal water, similarly releasing occluded gases and also mixing up the mud with the water. It is known that microseisms (as Prof. Woodworth terms them) are radiated from this locality, and it is believed by some that they are due to the West Indian cyclonic storms.

This seems to be the most promising hypothesis. It might be expected that the water flowing into this region carries a large amount of organic matter leached from the abundant Florida vegetation and held in colloidal solution; that this organic matter, on striking sea water heavily charged with lime is flocculated and falls to the bottom on the uncommonly wide expanse of continental shelf in this region; that as it accumulates on the bottom it decays anaerobically, yielding methane, hydrogen sulphide, possibly carbon monoxide, and other gases; that these gases, as generated, are confined by the pressure, increasing sediment, and, perhaps by the limestone crust which appears to cover the bottom; that an earthquake shock, even an unnoticeably mild one, would so disturb the sediment, or break the crust, as to release the occluded gases, and that these gases work, by various physiological and chemical means, the injury to fishes. These organic gases, being rare in sea water, would never be detected by the ordinary analyses.

The work of Prof. J. P. McClendon at Tortugas, in the summer of 1916, suggests that the marginal supply of oxygen in this region is not great. In a letter on the subject he says:

I think probably lack of oxygen killed the fish. When the  $P_H$  of tropical sea water reaches about 7.5 there is no oxygen left in the water. At Tortugas the  $P_H$  was about 8.15 and there was about 4 cc. of oxygen per liter.

It would, of course, be necessary to explain any deficiency of oxygen.

#### ALKALINITY AND SALINITY OF THE WATER.

These two determinations were made as being most likely to reveal any unusual condition of the water. The alkalinity is somewhat higher than that of pure sea water. Dole found this to vary between 0.00237 N and 0.00257 N; McClendon found the alkalinity at Tortugas in 1916 to lie between 0.0023 N and 0.0025 N, while the samples taken in the region under discussion had an alkalinity varying from 0.00236 N to 0.00297 N. This may be explained by the large amount of fresh water flowing into the salt water in this region, which is generally rather strongly alkaline. The salinity is lower than that of pure sea water; this is likewise explained by the fresh water flowing in.



It is noteworthy that the water in which the filefish was seen to die was of the highest salinity and lowest alkalinity found. Otherwise, there seem to be no factors showing any striking correlation.

The following are the results of such determinations as were made:

## ALKALINITY AND SALINITY.

Date.	Fraction of normal alkali.	Salinity.	Remarks.
1916.			
Nov. 19.....	0.00297	$\frac{r}{on}$ 29.94	In shallow water at Bailey's wharf, Sanibel, where filefish died.
Nov. 13.....	.00294	32.81	Sanibel post-office wharf; surface; day before storm; sealed in glass; 76.5° F.
Nov. 16.....	.00289	31.52	Sanibel post-office wharf; surface; day after storm; 65° F.; very low tide.
Nov. 19.....	.00288	30.61	Bailey's wharf, Sanibel; 2 fathoms (bottom); 50 feet from point where filefish died; live mangrove snappers.
Nov. 14.....	.00282	33.93	One-half mile from Point Ybel Light, San Carlos Pass; 75° F.
Do.....	.00277	34.20	One and one-half miles from Point Ybel Light, San Carlos Pass; sample from surface; water 2 fathoms; 72.4° F.
Nov. 15.....	.00277	32.96	Place where mullet died, shallow water of Tarpon Bay; described by fisherman; 1½ hours before storm; 75.3° F.; live conchs; porpoises in water.
Prior to Nov. 13.	.00272	33.10	Specimens submitted by West Coast Fish Co., Kitchens Island, Pine Island Sound.
Nov. 19.....	.00261	30.97	Bottom (2 fathoms) off Point Ybel Light wharf, Sanibel, 1½ miles from point where filefish died; 65.4° F.
Nov. 15.....	.00260	32.43	Near Gulf mouth, Blind Pass; rising tide; surface sample; 2½ fathoms water; 20 minutes before storm broke; 75.8° F.; probably pure Gulf water.
Nov. 19.....	.00236	31.98	Surf water on Gulf Beach.
Mean.....	.00276	31.56	

## OTHER MORTALITIES DUE TO OBSCURE CAUSES.

Other mortalities have occurred in different parts of the world, due to obscure causes. Austin H. Clark (1903) observed a mortality of fishes on the coast of Venezuela, which seems similar to that off the Florida coast. Nordenskiöld (1882) noted dead *Gadus polaris* in the Siberian Polar Sea, which he supposes to have been killed by an insufficiency of oxygen, under the ice, where the fish were confined. Cold has unquestionably brought about the death of fishes in many parts of the world.<sup>a</sup>

Gilchrist (1914) cites numerous mortalities on the South African coast in addition to those already cited, ascribed to *Peridinium*, *Noctiluca*, and diatoms, but altogether without satisfactory explanation. One, however, deserves particular mention. In this case (which repeats itself annually at Knysna) there was a narrow streak of yellowish water extending along the coast for miles, of a temperature about 10° F. lower than the blue ocean water farther out, which was clearly marked off from the yellowish water. The author attempts to explain this by the meeting off this coast of the Mozambique (warm)

<sup>a</sup> On Feb. 2 and 3, 1917, a "freeze" occurred on both coasts of Florida, killing thousands of fishes. This cold wave is described by R. H. Fitch in a forthcoming paper of the Weather Bureau.

and the Antarctic (cold) currents by which the cold water is forced upward along the coast and is limited offshore by the warm current. The periodic nature of the phenomenon is, however, not explained.

This mortality of fishes on the Florida coast may be of interest and importance in many respects. It would hardly be an exaggeration to assert that the number of fishes that perished would be sufficient to supply the State of Florida for a season. Yet a few weeks after normal conditions were restored we were informed that fishing on the Florida coast was as good as ever.<sup>a</sup> These facts give rise to the suggestion that, enormous as are the numbers of fishes in our coastal waters, natural causes may be quite as destructive to them as are the activities of man.

The question has arisen repeatedly as to the means by which the strata, rich in fossils of fishes, were laid down. Instances like this and dozens of other in as many parts of the world readily answer the question. Large numbers of decaying animals may also have a bearing on the formation of other mineral beds—the phosphates, for example, that might be produced from the organic phosphorus.

It is also true that, if this misfortune should occur again, valuable information may be gained concerning the presence and number of the various species of fishes, their winter habitat, distribution of sizes, etc., from a study of the dead fishes themselves.

### SUMMARY AND CONCLUSIONS.

A mortality of fishes occurred on the coast of Florida from October 3 to the last of November, 1916, appearing progressively southward from Boca Grande to Marco, and apparently killing representatives of all local species of fishes, but very few other aquatic animals, in the sounds inclosed by the keys and in the Gulf of Mexico for a distance of 45 miles or more, but not affecting fresh-water forms. Meteorological conditions were normal. Post-mortems revealed nothing pathological in the fishes. The salinity of the water was somewhat lower than that of normal sea water, and the alkalinity somewhat higher.

The cause of the mortality in this region, as has been stated, has not been determined. Foul water from the Everglades as a possible cause may be dismissed, as well as all meteorological conditions. Volcanic action is highly improbable, and attention need not be turned to such a possibility from the evidence now at hand. *Peridinium* appear to furnish an exceedingly unlikely explanation, but it is, perhaps, proper to reserve judgment, as the evidences contrary to such an explanation are not altogether convincing. A disease

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<sup>a</sup> Later reports (April, 1917) from the *Grampus* indicate that the fishing was poor through the winter season.

seems to be a quite impossible explanation. Some geological, perhaps seismological explanation, such as Prof. Woodworth suggests, appears to be the most promising possibility.

Aside from the continued recurrence of the phenomenon in the past, we have no data on which to base a prediction as to future recurrences. In the event of a verification of the seismological-sedimentary hypothesis, a recurrence may be expected sometime. In such an event oceanographic methods should be resorted to at the first indication of the trouble; in the meantime a collection of bottom and water samples over the region is desirable, and, if possible, gas bubbles, if present, should be collected from the mud by appropriate apparatus.

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# **FISH ISINGLASS AND GLUE**

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By **GEORGE F. WHITE**

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**Appendix IV to the Report of the U. S. Commissioner of Fisheries for 1917**



# FISH ISINGLASS AND GLUE.

By GEORGE F. WHITE,

## COLLAGEN AND GELATIN.

Collagen, the mother substance of gelatin, is an albuminoid which occurs to a large extent in vertebrates and also in the flesh of cephalopods. It is the chief constituent of the white fibrils of connective tissue and is also found in bones, cartilages, ligaments, fish scales, etc. Collagens of different origins are not of identical composition; however, all show the characteristic albuminoid property of being insoluble in water and the ordinary protein solvents.

The most interesting and commercially important property of collagen is its power to be converted into gelatin by heating with water alone or in the presence of dilute acids. On the other hand, if gelatin is heated to 130° C. it is transformed back into collagen, so that there is a very intimate relation between the two substances. For practical purposes we may consider gelatin to be collagen which has been converted into a soluble form by combination with water. (Other changes have been noted, such as the evolution of ammonia, when collagen is treated with water.) The following table gives the composition of collagen, gelatins from various sources, and of fish glue, which is a crude form of gelatin:

COMPOSITION OF COLLAGEN AND GELATIN.

	Carbon.	Nitrogen.	Hydrogen.	Sulphur.	Oxygen.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Collagen .....	50.75	17.86	6.47	.....	<sup>a</sup> 24.92
Gelatin from—					
Commercial source .....	49.38	17.97	6.80	0.7	25.13
Tendons .....	50.11	17.81	6.56	.26	25.26
Ligaments .....	50.49	17.90	6.71	.57	24.33
Cartilage .....	50.34	17.76	6.96	.58	.....
Trachea .....	.....	17.87	.....	.70	.....
Ear .....	.....	.....	.....	.66	.....
Air bladder .....	48.69	17.68	6.76	.....	.....
Fish scales .....	.....	17.51	.....	.52	.....
Fish glue .....	48.69	17.68	6.76	.....	.....

<sup>a</sup> Includes sulphur; separate percentage not noted.

Collagens are to a certain extent differentiated by the ease with which they are converted into gelatin. Thus the collagenous cartilage of the trachea is transformed at 100° C. into gelatin, whereas ear cartilage requires a temperature of 110°; the collagen of air bladders forms gelatin at room temperatures. In general, the formation of gelatin takes place most readily with fishes and amphibia, more slowly with birds, and very slowly with old animals. The presence of salts, for example, of sodium chloride in a concentration of 10 per cent retards the transformation.

Gelatin (French *gélatine*, Latin *gelata*, that which is congealed) is a colorless, amorphous substance which is transparent when in thin sheets. It does not dissolve in cold water, but swells in this medium. If treated with warm water, it dissolves to a sticky liquid which, if sufficiently concentrated, sets to a jelly on cooling. If gelatin is boiled with water for several hours (or simply digested with water for two days at a temperature of 37° C.), it is converted into a nongelatinizing form; further boiling transforms it into proteoses, peptones, and finally into acids, among which glycocoll is present in a characteristically large amount. This fact should be borne in mind in a study of the commercial uses of gelatin, since prolonged boiling, especially in the presence of acids, changes it chemically and physically (the gelatinizing) and correspondingly the adhesive power is destroyed.

As a food, gelatin has little nutritive value, and should not be substituted for other proteins of the normal diet since not all of its nitrogen is in a form which can be utilized by the organism.

Gelatin, obtained as described above, should not be confused with the products derived from algæ and seaweeds of different varieties, especially those of the East Indies, China, and Japan. Thus the gelatinizing substances obtained from bird's nests, prized as a delicacy by the Chinese, and Bengal isinglass, or agar, yield carbohydrates in large amount and have no relation chemically to true gelatin.

#### FISH SOUNDS.

While the principal supply of gelatin is to-day obtained from the refuse of animal bones, hides, and hoofs in the slaughter and packing houses, the peculiar properties of the gelatin derived from fish sounds, called isinglass in the trade, makes this product of considerable commercial importance.

The fish sound (air bladder, or swim bladder) is a hollow sac, containing gas (oxygen, carbon dioxide, and nitrogen), situated in the abdominal cavity below the vertebral column. Its principal function is probably mechanical. Since it is compressible, it serves to regulate the specific gravity of the fish, enabling the latter to rise



and sink or to maintain its position at a certain water level. In a few fishes it may take on the functions of the lung of higher vertebrates and may be considered to be the homolog of that organ.

The size of the air bladder varies to a great extent, being very small in some species, whereas in the sturgeon, hake, catfish, and carp it is highly developed. In some fishes the sound is practically loose in the abdominal cavity, while in others it clings closely to the backbone, the intestines, and the abdominal wall. The sound is made up of several tunics of which the inner layer is thin, often with a silvery luster, containing crystalline substances, sometimes covered with a pavement epithelium. The adjacent layer is thick and with a fibrous structure; it is the collagen contained in this layer which is the source of commercial isinglass.

Isinglass (probably a corruption of the Dutch *huisenblas*, German *hausenblase*, literally sturgeon's bladder) has for centuries been manufactured and exported from Russia. Several varieties of the sturgeon (*Acipenser huso* or beluga, *A. ruthenus* or sterlet, *A. sturio* or common sturgeon, *A. stellatus* or starred sturgeon), the catfish (*Silurus glanis*), and the carp (*Cyprinus carpio*), flourishing in the Volga and other rivers, in the Caspian and Black Seas, and in the Arctic Ocean, yield the well-known Russian isinglass.

Russian isinglass is generally brought to the great fair at Nijni Novgorod and from there finds its way, through the agency of Petrograd traders, to London and elsewhere. Other sources of supply than Russia are Brazil, Venezuela, the East and West Indies, Penang, Bombay, Manila, Nova Scotia, Newfoundland, and the United States. Russian isinglass is known in commerce as staple isinglass, and is sold as long and short staple, according to size.

Leaf isinglass (Astrakhan leaf, Saliensky leaf, Samovy leaf, etc.) is prepared by soaking the sounds in warm water, whereby dirt and mucous membrane are removed. The sounds are then opened and dried by exposing the inner membrane to the air; the dried sounds may be further treated by pounding and rubbing until the outer membrane is detached and separated from the purer, inner layer. Book isinglass is prepared in a similar manner, but the sounds are folded and covered with a damp cloth. Trimmings from the leaf or book are pressed into cakes or tablets or rolled into ribbons and sold as lower-grade isinglass. The trimmings from the sounds and other parts of the fish are often boiled in water until the gelatin dissolves and the filtered solution is evaporated to dryness. There is also cake isinglass, so called from its shape, although sometimes it is made in a globular form.

Long staple and book isinglass are the best varieties, a 2 per cent solution in hot water setting to a jelly when cold, and yielding only 0.05 per cent insoluble matter. Cake isinglass is dark colored and

of unpleasant odor. A low grade of Russian isinglass, also sold under the above names, is manufactured from the peritoneum and intestines of the fish. Russian isinglass is imported into the United States in varying amounts from year to year.

Iceland produces an excellent grade of isinglass, which is obtained from cod and ling sounds, only a little inferior to the Russian product. Venezuela and Brazil export tongue sounds and lump and pipe isinglass which are obtained from Siluridæ and other less definitely characterized fish. Tongue sounds are oblong, tapering, and pointed at one end, of firm consistency, but otherwise poorer than the Russian product. From Penang and Bombay are exported tongue sounds and also purse sounds, so-called from their shapes and their fringed edges.

The value of the imports of sounds into the United States and countries from whence imported, according to the census of 1908 (Fisheries of the United States, 1908, p. 292), are given in the following statement:

Canada .....	\$62, 365	British India .....	\$4, 113
United Kingdom .....	22, 721	All other countries.....	3, 863
Venezuela .....	13, 907		
European Russia .....	6, 706	Total .....	113, 675

The production of fish sounds in this country has fallen off in the last few years, and the demand being good the value of the imports has increased. Norwegian cod sounds have been imported at different times.

North American isinglass is derived from the sounds of hake, cod, and squeteague, hake sounds being the principal source. A few years ago over 100 tons of hake sounds were obtained annually on the New England coast alone, but the production has fallen off considerably in recent years. Large amounts are imported from Canada and Newfoundland.

Hake sounds from fish caught in deep waters off the coast of Nova Scotia are large and of good quality. One ton of these fish yields 300 to 500 sounds, weighing from 40 to 50 pounds. Hake sounds from shallow waters are smaller and of a lower grade; 1 ton yields about 600 sounds, weighing approximately, 30 pounds. Hake sounds are easily detached from the backbone in dressing the fish on the fishing vessels, and then they are salted in barrels. Before salting they may be scraped and washed but these operations are usually omitted without much injury to the character of the isinglass manufactured from them. When delivered on shore, the sounds are slit open and thoroughly washed and the black outer membrane is scraped off. They are then dried in the air with precautions to prevent access to moisture, since they readily putrefy. The average hake sound yields about 85 per cent gelatin.

Cod sounds are smaller than those of hake and of poorer quality. One ton of fish yields 15 to 20 pounds of sounds. As they are more firmly attached to the backbone than are hake sounds, they are cut off with part of the backbone, scraped, washed, and salted. They are then washed and dried on shore. Cod sounds yield only about 50 per cent gelatin, so that they are much less valuable than hake sounds.

Sounds of the squeteague, which fish occurs along the Atlantic seaboard, are at present only little utilized. One ton of fish yields about 20 pounds of sounds, which are of as good quality as cod sounds. Over 30 years ago about 15 tons of dried sounds of the squeteague were sold annually, but the production since that time has dwindled to a negligible amount.

The production and value of fish sounds in the United States as reported in the census of 1908 (Fisheries of the United States, 1908, p. 43) are presented in the following table:

	Pounds.	Value.
Maine.....	23,000	\$1,000
Fresh.....	20,000	900
Salted.....	2,800	100
Massachusetts (fresh).....	73,000	3,100
United States.....	96,000	4,100
Fresh.....	93,000	4,000
Salted.....	2,800	100

The sounds of many fresh and salt water fishes are at present unutilized.

#### TILEFISH-SOUND TEST.

The sound of the tilefish (*Lopholatilus chamaeleonticeps*) was tested by the writer to determine the character of its principal constituent and its possible utility. The sound was cut open and a portion treated as follows: After thorough washing with water the tissue was allowed to stand under a large excess of 0.1 per cent sodium hydroxide solution at room temperature so that mucin, hæmoglobin decomposition products, etc., might be dissolved. The residue was thoroughly washed with water and then subjected to the action of an active trypsin solution containing 0.2 per cent sodium hydroxide for 24 hours, the temperature being maintained at 37.5° C. and in the presence of chloroform to prevent putrefaction. The tissue was largely unaffected, and after washing with water was treated successively with alcohol and ether to remove any lipoids. The residue, after drying at 70° C., was creamy white, and thin layers were transparent.

On continued boiling with water, much more quickly by the addition of a trace of acid, the treated tissue dissolved and the solution

set to a jelly on cooling. This fact, combined with its ability to withstand tryptic digestion, indicated the presence of collagen in the original tissue, and further tests confirmed this conclusion.

The collagen was rapidly hydrolyzed by pepsin in hydrochloric acid solution. It was found to be insoluble in dilute alkalies and acids but swelled in the latter on standing.

An aqueous solution of the collagen (obtained by boiling with water) was tested for gelatin as follows: The solution could not be coagulated by boiling, by mineral acids, acetic acid, lead acetate, or other metallic salts. It could be precipitated, however, by alcohol, picric acid, tannic acid in the presence of sodium chloride, or by potassium ferrocyanide in the presence of acetic acid. It gave a blue-violet biuret test, but no Adamkiewicz or xanthoproteic reaction. Millon's test gave only a slight precipitate with little color. These tests show the presence of gelatin and the absence of other protein matter.

The presence of collagen (rough experiments showed that over 90 per cent of the nitrogenous matter of the swim bladder is collagen), and the fact that it may be readily converted into gelatin allow the sound of the tilefish to be put to the same use as the sounds of the sturgeon, hake, and other fishes.

#### MANUFACTURE AND USES OF ISINGLASS.

Isinglass is manufactured by an exceedingly simple process. The industry was initiated in the United States in 1821, at Rockport, Mass., cleaned hake sounds being pressed into plates. In 1834 the procedure was somewhat improved, and the cleaned sounds, softened to the desired consistency by soaking in water, were converted into ribbon isinglass by being passed between solid rollers. The ribbons were then dried. In 1848 the solid rollers were replaced by hollow iron rollers, through which cold water could flow, and thus prevent the ribbons from softening and sticking to the iron, as they are apt to do, especially in warm weather. In 1873 a scraper was placed against the rollers to remove all isinglass adhering to them. The ribbons were made to the desired thickness by adjustment of the space between the rollers.

The manufacture of isinglass is best carried on through the cooler months on account of the softening and putrefying effect of a slight rise in temperature. The sounds received, generally, have been previously cleaned, perhaps scraped, de-salted, and air-dried. They are usually in a hard and tough condition, so they must be first immersed in water for several hours. Four to six hours may be required for the gelatin to absorb enough water to be sufficiently pliable to handle. The sounds may now be run into a cutting machine provided with a roller and a set of knives which chop the sounds into

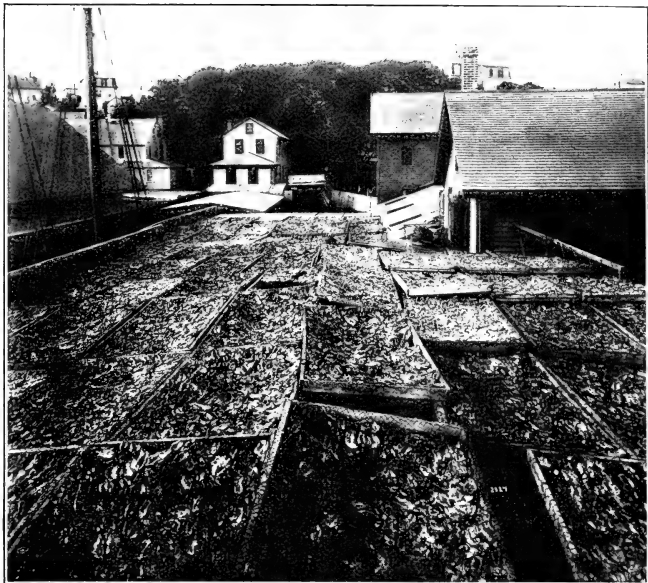


FIG. 1.—DRYING HAKE SOUNDS FOR ISINGLASS MANUFACTURE.



FIG. 2.—ROLLING HAKE SOUNDS FOR ISINGLASS.

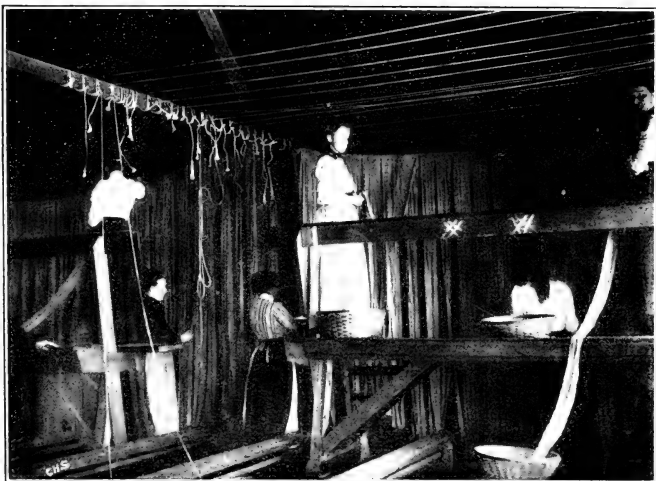


FIG. 1.—DRYING-ROOM OF ISINGLASS FACTORY.

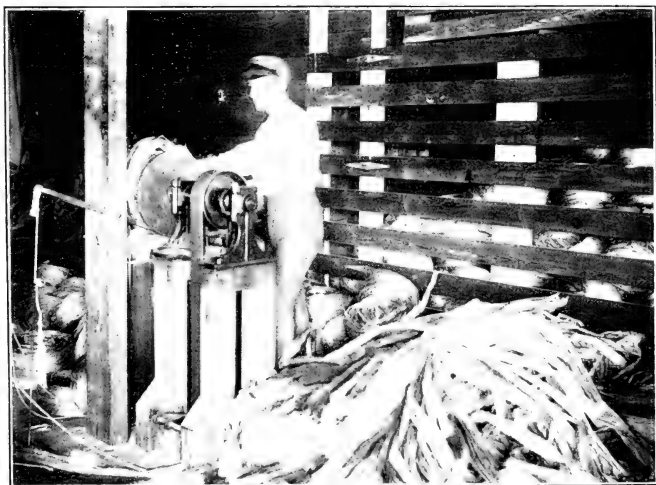


FIG. 2.—WOODEN SPOOL FOR ROLLING INTO COILS.

small pieces. This material is then further mixed and macerated between a set of iron rollers, from which it passes to so-called sheeting rollers. These are the hollow iron rollers, cooled by water and provided with a scraper, as mentioned above. The gelatin is converted into sheets one-eighth to one-fourth inch thick, 6 to 8 inches wide, and of variable length. These sheets are finally passed through ribbon rollers until the ribbons produced are one-sixty-fourth of an inch thick; the width is the same as that of the sheets. The ribbons are dried in a few hours by being suspended in moderately warm, light rooms; they are then rolled on wooden spools into coils weighing less than a pound each. About 20 per cent of the weight of the original sounds is lost during their conversion into isinglass.

A product called transparent or refined isinglass is manufactured by dissolving New England isinglass in hot water and spreading the solution to dry on oiled cloth. Very thin, transparent sheets are thus produced, and these yield an excellent grade of glue, but retain a rather pronounced fishy odor.

When the best grades of isinglass are treated with hot water, they swell uniformly, produce an opalescent jelly, and finally entirely dissolve. Isinglass is insoluble in alcohol, but readily soluble in most dilute acids and alkalies. When ignited, isinglass should yield no more than 0.9 per cent ash, whereas poorer grades of fish glue, or gelatin, yield from 1.5 to 4 per cent ash.

Isinglass has been adulterated by rolling a layer of gelatin between two layers of isinglass. Such adulteration may be detected by treating with water and observing the nature of the colloidal solution under the microscope. Isinglass retains its characteristic fibrous structure which is not present in a gelatin solution; the gelatin becomes more transparent than before, the shreds being disintegrated. Both of these effects would be observed in the adulterated article.

The results of the analyses of some different forms of isinglass are presented in the following table:<sup>a</sup>

Source of isinglass.	Ash.	Water.	Residue insoluble in hot water.	Source of isinglass.	Ash.	Water.	Residue insoluble in hot water.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Astrakhan.....	0.20	16.0	2.8	Hamburg.....	1.30	19.0	2.3
	.37	18.0	.7		.13	19.0	5.2
	.20	17.0	1.0	Iceland.....	.60	17.0	21.6
	.80	19.0	3.0	East India.....	.78	18.0	8.6
	.50	19.0	.4	Yellow, unknown			
	.40	17.0	1.3	source.....	2.30	17.0	15.6

It may be readily observed that the Russian isinglass (Astrakhan) is by far the best of those samples analyzed.

<sup>a</sup> Prollius, I. F.: Abs. Journal of the Chemical Society, p. 647. 1884. London.

The use of isinglass for edible purposes has become practically obsolete since the manufacture of gelatin on a large scale has become a function of the slaughter and packing houses. It was formerly utilized to stiffen jellies and jams and in the manufacture of confectionery, but has no peculiar medicinal properties. Some fish sounds have been esteemed as an article of food; thus it is said that fried cod sounds have a flavor resembling that of oysters similarly cooked.

Isinglass has long been used as a clarifying agent for beverages such as cider, wines, and malt liquors. The peculiar clarifying action is purely mechanical, those substances causing turbidity becoming entangled in the slowly sinking network of gelatinous material. This property is not possessed to the same degree by gelatin prepared from animal bones, hoofs, or hides, and such gelatin is far less efficient as a clarifier. English brewers of malt liquors prefer the Penang product, while Scottish brewers employ Russian leaf isinglass. English cider manufacturers generally use Russian long staple. American brewers formerly considered Russian isinglass as superior to other kinds, but later adopted the use of the ribbon isinglass made from hake sounds in this country.

White wines are usually clarified by isinglass. The isinglass is allowed to swell in water and then in wine until it is practically transparent. It is thoroughly beaten with more wine, a little tartaric acid being eventually added; after filtering through linen it is stirred into the wine. One ounce of isinglass will usually clarify 200 to 500 gallons of wine in 8 to 10 days.

In the storage of beer after the primary fermentation all suspended particles do not settle in the stock tanks. This is true of starch granules, bacteria, some of the protein matter, etc. From storage the beer is run into chip casks where it is carbonated by charging with carbon dioxide directly or by the addition of young beer, and at the same time clarified or fined. This latter process is carried out by the addition of chips or of isinglass, or by filtration. When isinglass is employed, it is treated with sour beer, acetic, or other weak acid whereby it is not actually dissolved, but is "cut" by the acid. Finings thus prepared have an excellent clarifying action. One pound of isinglass will fine 100 to 500 barrels of beer.

Isinglass is the basis of some of the best adhesives. Although formerly used for postage stamps, envelopes, and gummed paper, the dextrins prepared from starch have largely taken its place. Mixed with two parts of alcohol a "diamond" cement is obtained, the cooled solution forming a white, opaque, hard solid. Dissolved in acetic acid another powerful cement is obtained, especially useful in repairing glass, pottery, and similar articles. Various modifications



of these cements are prepared, particularly by the addition of some adhesive gum which will render the cement insoluble in water. Following is the formula for one of these: 10 grams isinglass, 5 grams gum ammoniac, 5 grams mastic, 80 grams alcohol. The isinglass and gums are dissolved separately in the alcohol and then heated together over boiling water. The excellent properties of isinglass as a glue may be illustrated by the fact that leather belts for machinery are repaired by the use of this agent. (In the trade it is often called Russian fish glue.)

Court plaster is made with isinglass as the adhesive. The proportions used are 10 grams isinglass, 40 grams alcohol, 1 gram glycerin, and water and tincture of benzoin in sufficient amount. The isinglass is dissolved in enough water to make the total weigh 120 grams. One-half of this solution is spread in successive layers, with the aid of a brush, on taffeta stretched on frames; each layer is allowed to dry before the next is applied. The second half of the isinglass solution is mixed with the alcohol and glycerin, and is applied to the cloth in a similar manner. The reverse side of the taffeta is covered with a layer of tincture of benzoin and allowed to dry. The above quantities are sufficient to cover a piece of taffeta 38 centimeters square.

Mixed with a gum, isinglass has been used as a size for textile goods, imparting a luster and stiffness to linens and silks. Combined with water, Spanish liquorice, and finely divided carbon, india ink may be made. A patent for waterproofing fabrics has been obtained by Van Winkle and Todd (English patent 20690, 1890), who recommend a combination of isinglass and pyroxylin dissolved in acetic acid; experience has shown that a bichromate must be added to the mixture or the isinglass rendered insoluble by formaldehyde for the mixture to be successfully used. Isinglass has in past years been used to adulterate milk, the addition of a small amount adding considerably to the body.

The manufacture of isinglass in this country is rather inconsiderable as compared with the supply of fish sounds. According to the census of 1908 ("Fisheries of the United States in 1908," p. 282), the value of the annual production of isinglass in this country was reported to be \$150,000, all of this coming from Massachusetts.

#### FISH GLUE.

Glue is gelatin contaminated usually with various decomposition products such as gelatoses, peptones, and organic acids. The purer the gelatin the better glue it yields, so that a good glue should be as free as possible from other proteins, from hydrolytic splitting prod-

ucts, and from ash. Fish glue is usually made up into liquid glue, for which there is a reasonably large demand. The manufacture of mucilage and pastes of various sorts from the dextrins obtained from starch has largely limited the demand for fish glue so that enterprises based solely on this product have not been very profitable.

The manufacture of fish glue in this country has been confined practically to three States, Massachusetts, Maine, and California, 95 per cent of the value of the product being credited to Massachusetts. For 1908 the value of the entire output in the United States was \$631,000; the value of the New England output was \$611,000 and of the Pacific coast output \$20,000.

In New England fish glue is made from cod heads, skins and bones, haddock residues, and all fish offal containing little or no oil, as this constituent is fatal to the production of a good glue. The refuse from salting factories forms a very large part of the source of supply, as salt codfish is prepared in considerable quantities in this region. The refuse from sturgeon and the skins and scales of menhaden and herring have been used. Green and Tower<sup>a</sup> have shown that 1 ton of menhaden yields 20 pounds of dry scales from which 10½ pounds of pure gelatin (containing 16 per cent moisture) may be obtained. In this connection it may be noted that the adhesive qualities of the "stick" obtained by the present methods of concentrating the waste liquors of the menhaden industry are due to the large percentage of gelatin present; this material as now manufactured has use only in the fertilizer industry, as it contains too much salt, oil, and foreign protein substance to be serviceable for glue. Many other fish residues are now unutilized; such is the case of the mullet of the southern waters, which yields an excellent quality of glue.

In the last few years whale blubber has been utilized for the production of glue. According to the German patent 131315, the blubber is chopped up, freed from most of the fat by pressing in the cold, and the remainder of the fatty matter is extracted by some solvent, as benzene. By this method all the fat is recovered and a fat-free dry residue consisting of tissue containing the gelatin is obtained, and this may be readily converted into glue.

Attempts to produce glue from the grayfish (*Squalus acanthias*) have not been successful on account of the large amount of oil and water in the fish, the difficulties attended with the extraction of the oil, and the presence of dark pigments in the skin which discolor the extracts. It is also probable that the skeleton contains only a small amount (if any) of collagen or glue-forming substance. The flesh of the smooth grayfish (*Mustelus canis*) contains gelatin-forming material and presents possibilities as a source of glue.

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<sup>a</sup> U. S. Fish. Com. Bull., 1901, p. 97-102.

## MANUFACTURE AND USES OF FISH GLUE.

In the manufacture of fish glue the fish wastes are first washed thoroughly with cold water to remove dirt and blood from the fresh fish and salt from the salted fish. The washed material is allowed to drain, the washings being discarded, and then is subjected to the action of hot water or steam.

In the older methods of preparing glue the crude material was treated with water and the mixture boiled in open glue kettles for several hours until the collagen had all been converted into gelatin which dissolved in hot water. This method yields a fairly good glue if the raw materials are clean and fresh, but because of the lengthy time required for complete extraction the liquor obtained is usually dark colored and contains in solution many other protein substances than gelatin. Glue thus prepared is often a poor adhesive and is malodorous.

Newer methods of fish-glue manufacture involve heating the stock with steam under pressure in an autoclave so that the extraction proceeds rapidly and there is less time for decomposition of the fish protein to occur. In some plants the stock is placed in tall iron cylinders, steam-jacketed, and heated for several hours until the whole mass is thoroughly digested. By a better method, the stock is placed within the inner, perforated section of a double boiler. Steam enters the inner vessel from the outer, and the whole is heated under pressure. The glue liquor filters out of the inner vessel and may be drawn off from the outer jacket continuously. Sometimes an alternate action of steam and cold water on the stock is brought into play, and this process repeated until the extract is too dilute to be profitably worked up into glue.

The digested fish wastes may be filter pressed and the residue dried. The resulting product, containing 45 to 55 per cent protein matter, and 1 to 2 per cent oil, is a valuable by-product; in fact, on account of the demand for it, the scrap can be considered to be the main product of the industry and the glue to be of only secondary importance. At any rate, the manufacture of glue alone would not pay. The better grades of scrap are used for poultry food under the name "chum," while second grades are sold for fertilizer, for which there is always a good market.

The solutions running from the autoclaves or the filtrate from the filter presses are run into vacuum condensers, since the excess moisture in the glue liquor must be distilled off at as low a temperature as possible in order to prevent unnecessary decomposition of the dissolved gelatin. In general, vacuum evaporators consist of a spherical or cylindrical iron vessel, steam-jacketed and provided internally with steam coils immersed in the glue liquor. Sometimes,

in modern plants, a type of evaporator used has revolving steam coils; the solutions are thereby uniformly heated and undue frothing from local superheating is prevented. The distilling head is provided with baffle plates and is connected with a vacuum pump and condenser. To conserve fuel, the steam from one evaporator is led through the coils and jacket of the next in a series, on the principle of multiple effect. After concentration to the desired consistency (fish glue contains usually about one-half its weight of water) the product (fish glue) is run while still hot through cloth filters into a receiving tank.

Since fish glue generally does not yield a very good jelly when cooled, on account of the presence of impurities, it is employed as liquid glue. To prevent the glue from gelatinizing at room temperatures an acid such as hydrochloric or acetic acid is added, and the adhesiveness of the material is little affected. Since it is not required that this liquid glue be heated or be applied to hot surfaces, there has been a reasonably large demand for it. It has been largely used as a size for straw goods, especially where it has been treated with sulphurous acid, since this latter agent bleaches the straw; it is also employed as a size for textiles. Good grades of fish glue are used for court-plaster, but isinglass is a better adhesive for this purpose. The greatest demand for fish glue comes from the general demand for a liquid adhesive.

Davidowsky<sup>a</sup> describes the manufacture of fish glue as follows:

The principal point to be observed in the manufacture of fish glue is the removal of the skin, which is effected by means of dilute sulphuric acid. After the removal of the last traces of acid, the fatty matter of the fishes is saponified by treatment of milk of lime frequently renewed. After washing out the lime, the pulpy mass is placed in a solution of sodium hyposulphite, alum, and sodium chloride, and left for a few days. The liquor is drawn off and replaced by a mixture of solutions of alum, dilute sulphuric acid, and nitric acid. After macerating in this mixture for a few days, the mass is thoroughly washed and boiled to a glue, and the resulting product is clarified with sulphurous acid or alum.

As will be seen, the entire process requires many chemicals, and besides, the yield of glue, which has no especially good qualities, is small. It is used as a substitute for isinglass for clarifying.

That the manufacture of fish glue alone is not very profitable may be seen from the fact that glue manufacturers do not rely on this one product as a source of profit. Thus, one Massachusetts company sells large quantities of fertilizer and also cod-liver oil. Another offers to the trade glue, ink, lubricating oil, paste, mucilage, and other products.

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<sup>a</sup> Davidowsky, F., 1905: "Glue, gelatin, animal charcoal, phosphorus, cements, pastes, and mucilage." Translated from the German by W. T. Brannt. Philadelphia.

Lambert<sup>a</sup> discusses fish glue and describes its manufacture as follows:

The fish offal is carried by conveyors to a series of washing tanks placed overhead, and thoroughly washed with water to remove the blood, etc. From thence it falls by gravitation into the digesters, and is heated with "live" steam for 10 hours. The oil and gelatinous water are drawn off by a pipe fixed to the bottom of each digester, into tanks, the oil skimmed from the surface, and the glue liquors clarified with a small portion of alum. On filtering they are concentrated in open vats provided with a steam coil, to a strength of 32 per cent dry glue, and then bleached with sulphurous acid. The residue in the digester is converted into guano.

Fish glue is a light brown viscous liquid with offensive odor and acrid taste. It forms a sticky mucilage when diluted with water, and as met with in commerce, already contains about one-half its weight of water and such liquid is weight for weight, only about equal to a dextrine in viscosity.

The ash of fish glue is comparatively high, about 4 per cent on body dried at 100° C. It is usually white in color, and has besides carbonates of calcium and potassium, some 5 to 10 per cent phosphate of calcium. Fish glue is said to assume a greenish-yellow color on boiling with potash and absorbs about 9 per cent of the caustic. Liquid gums of this class are easily distinguished by boiling with Fehling's solution, when they assume a violet color, and by the tannic-acid reaction. The best method to remove the unpleasant odor and taste of fish glue is to boil the solution in a little water with 1 per cent phosphate of sodium and to add 0.25 per cent of saccharine.

The offensive odor of fish glue may also be disguised by the addition of creosote, oil of sassafras or wintergreen, or other substance with a strong odor.

There have been several methods proposed for the testing of glue, none of which are perfectly satisfactory. Among the more common tests are those of the viscosity and consistency of the jelly formed. The adhesive power of the glue, however, does not depend on the character of the jelly entirely. Glue is sold with regard to its physical properties, especially its color; all fatty matter should be absent.

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<sup>a</sup> Lambert, T., 1905: "Glue, gelatin, and their allied products." London.



# THE PIKES: THEIR GEOGRAPHICAL DISTRIBUTION, HABITS, CULTURE, AND COMMERCIAL IMPORTANCE

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Appendix V to the Report of the U. S. Commissioner of Fisheries for 1917





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By WILLIAM CONVERSE KENDALL, *Scientific Assistant, Bureau of Fisheries.*

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## INTRODUCTION.

Accurate and authentic accounts of the species of American pikes are scarce in ichthyological literature. Most accounts consist of traditions and unsupported statements interspersed with hypothetical generalities. This is partly, at least, due to the fact that in this country most students of fishes have been systematists who have had little opportunity to observe the habits of fishes, and the greater part of such information has been in the nature of more or less detached contributions and not always specifically reliable. The disjointed character and sparsity of authentic information regarding the members of the pike family provides one motive for the preparation of this paper. It does not pretend to add much new knowledge, but it affords an easy means of identification of the species and presents the supposedly well-authenticated facts, so those who have opportunities to make observations on the habits of one or more of the species may be encouraged to do so. It may lead others to verify or disprove the alleged facts and to increase our knowledge of these fishes, the value of which, now that they are becoming scarcer, is receiving recognition.

Except locally or restrictively, the pikes have been more or less regarded with aversion, especially by those who angle for the "nobler fishes," and they have acquired a reputation for voracity and destructiveness that has always been likened to those qualities in the shark. Fresh-water shark or, in the words of the poet, "tyrant of the watery plain" have always been common terms of opprobrium applied to the common large species of the family. However, it is gradually dawning upon many who have previously condemned one or the other or all of the pikes that these fishes have had their special place in natural economy and that in their natural interrelations they have been no worse than other predacious fishes in theirs. It is also beginning to be recognized that there are still proper places for them in both natural and human economy.

There is no doubt but that they all possess good qualities, but the different species differ in that respect, at least in popular opinion.

Of what the peculiar virtues of each consist depends much upon the view point, as did the alleged bad qualities. For example, there have been waters in which some pike and other fishes have lived in reciprocal counterpoise from time immemorial, notwithstanding the condemned "characteristic voracity of the pike." Supposing that at some particular time the pike had been rendered less voracious, the tendency then would have been toward an undue increase of the natural objects of that voracity, which had probably been relatively as voracious on their own part in devouring the eggs and young of the pike. The increase of these forms might have resulted in the extermination of the pike, which would naturally have been reflected upon the other forms by depriving them of a part of their customary and requisite food supply, consisting of the eggs and young of the pike, and so have resulted in the decrease, deterioration, or extinction of those forms upon which the pike had exercised that quality which had been generally regarded as superlatively bad. The foregoing illustration is only a partial statement of the disturbances possible through extraneous or unusual agencies.

It is, however, a phenomenon that is usually manifested as a result of overfishing, which amounts to the same thing as depriving the pike of its voracity, and similar to what often happens when black bass are introduced into pickerel ponds, of which there are many instances, but the cause of which has not been fully recognized. For instance, it has been recognized that black bass have practically exterminated pickerel in certain waters, but why the black bass afterwards deteriorated in size and number did not seem explainable. These facts may be equally applied to other fields and fishes as respects their artificial distribution, and particularly to the members of the pike family itself, for it should be borne in mind that the reverse process of the foregoing is just as effective. If the pike should be rendered more voracious or, what amounts to the same thing, unduly increased in number, it would signify that sooner or later the food supply would be depleted, with the result that the pike would be forced to depend more and more upon its own young and would finally figuratively swallow itself.

The problem in the culture of the pikes, as well as in fish culture in general, is, or should be, how by artificial propagation to maintain a natural balance. Therefore, the common practice of placing several kinds of predacious fishes in one body of water should be abandoned. Attention should be paid to not over two species intended for cultivation and the food supply for them. Preferably, the fishes should be those natural to the waters to be stocked or, if not the natural forms, those nearest like them. In other words, species to which the waters are suited should be used, and when two species are introduced they should be of different habits, particularly the fishes that

are least likely to prey upon each other and which do not subsist upon exactly the same kind of food.<sup>a</sup> Again, applying the foregoing to the members of the pike family, while many of the old balances of interrelations have been upset or seriously disturbed, if due caution is exercised they may be restored or new counterpoises established.

In the following pages citations to literature are by names of author and date of publication in parentheses, indicating the publication referred to in the appended bibliographical list.

#### CHARACTERISTICS OF THE PIKES.

The muskellunge, pike, and pickerels are all pikes in a generic sense. There are other fishes belonging to entirely different families and, therefore, structurally different and distinct from the true pikes, which, unfortunately, have the local names of pike and pickerel. The most common species thus designated belong to the perch family. The spinous dorsal fin possessed by these fishes readily distinguishes them from the true pikes. They are more properly designated as pike perch, wall-eyed pike, sauger, etc. The "pike" part of these names, however, signifies only a resemblance, yet in certain localities the pike perch is called "pike" and in others "pickerel." This is altogether unfortunate, as it has caused regrettable confusion, particularly in compiling statistics of the fisheries.

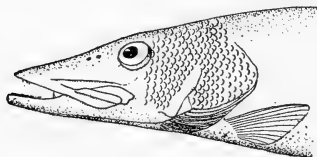
The true pikes are characterized by having a rather long, broad, flattish snout; a large mouth extending about halfway the length of the head; the lower jaw the longer; and both jaws provided with broad bands of teeth, which are coarse and rough like wool cards and more or less movable. The dorsal and anal fins are situated near the tail and are similar and opposite. The ventral fins are abdominal.

The preceding characters serve to distinguish the pikes from the pike perches, and the following will distinguish them from all other fishes having abdominal ventral fins: Body with ordinary scales; back without adipose fin but with a single dorsal fin made up of soft rays and not preceded by free spines; anal fin without distinct spines; tail forked; pectoral fin situated below the median line of the body from tip of snout to base of tail; head more or less scaly; gill membranes not attached to the prolongation of the body forward between the gill openings; no barbels; maxillaries distinct; upper jaw not protractile, that is, its forward end is firmly joined to the snout; both jaws provided with sharp teeth, varying in size and arranged in broad bands; snout somewhat prolonged and depressed.

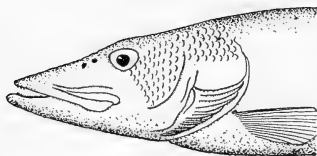
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<sup>a</sup> Jardine (1898) states that in artificial carp ponds in Germany it is the custom to keep a few pike, the carp culturist knowing just how many to introduce. A few act beneficially in destroying the smaller and weaker individuals of the carp stock, which would not attain a growth in three years commensurate to their consumption of food.

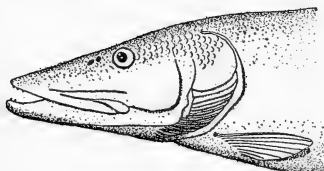
The pike family includes one genus only—*Esox*, the pikes—inhabitants of the fresh waters of the temperate parts of Europe, Asia, and America. The pike proper, *Esox lucius*, inhabits all three continents and is the only representative of the family in other than the North American continent. In North America there are now recognized five species, including the pike. These are the pike (*Esox lucius*), the muskellunge (*Esox masquinongy*), the eastern pickerel (*Esox reticulatus*), the banded pickerel (*Esox americanus*), and the little pickerel (*Esox vermiculatus*).



a



b



c

FIG. 1.—SQUAMATION OF HEAD OF PIKES.

a, Pickerel; b, pike; c, muskellunge.

The species vary in appearance among themselves according to locality, age, size, and sex, but it is only in muskellunge that subspecies have been designated, and these have been pronounced distinct species by some ichthyological authorities (Jordan and Evermann, 1902).<sup>a</sup>

Owing to confusion of local names, mistaken identifications, and the scant knowledge of the fishes of some regions, it has not been easy to decide positively regarding the exact geographical distribution of the muskellunge and pike in America, but the ranges of the other species have been fairly well made out.

The following key should enable anyone to distinguish any member of the pike family. In

this key, however, and in the subsequent text the usual order of arrangement has not been followed, but the most important species are first considered.

The genus is divisible into three groups according to the squamation of the sides of the head, which easily separates the muskellunge, pike, and pickerels.

<sup>a</sup> Pike and pickerel, particularly the latter, have had their original geographical range more or less extended by man with both good intentions and alleged malice aforethought. Also, places in which the fish was supposed not to occur have, at one time or another, been discovered to contain them.

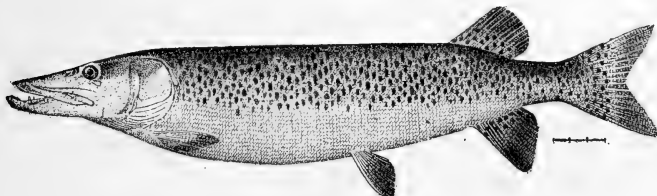
Jardine wrote that it had often puzzled naturalists to explain how newly made lakes or streams known to have never contained pike should suddenly have been found to be stocked with them. He added that some naturalists, including the late Frank Buckland, considered that waterfowl, such as ducks, coots, moorhens, or dabchicks, after feeding among aquatic weeds where vivified spawn had been deposited, on taking flight to other waters, conveyed some of the spawn, which is glutinous, sticking among their feathers or to their feet.

## KEY TO THE PIKES.

- a. No scales on lower half of gill cover (operculum).
  - b. Cheek, as well as lower half of gill cover, without scales.....Muskellunge.
  - b3. Cheeks entirely scaled, lower half of gill cover without scales.....Pike.
- aa. Gill cover and cheeks both entirely scaled.
  - c. Branchiostegals <sup>a</sup> normally 14 to 16; dorsal rays 14; anal 13....Eastern pickerel.
  - cc. Branchiostegals normally 12 (11-13); dorsal rays 11 or 12; anal 11 or 12.....
    - .....Banded pickerel, little pickerel.<sup>b</sup>

**MUSKELLUNGE** (*Esox masquinongy*).

The muskellunge comprises three more or less distinct color forms which have been variously regarded as subspecies or distinct species.<sup>c</sup> These are the Great Lakes and St. Lawrence fish, with irregular blackish spots on a ground color or grayish silver (*Esox masquinongy*); the Ohio drainage fish, including some Pennsylvania and New York lakes, with dark crossbars which split up into diffuse spots (*Esox ohioensis*); and the fish of the Wisconsin and Minnesota lakes and

FIG. 2.—MUSKELLUNGE (*Esox masquinongy*).

rivers, with body unspotted or with vague dark cross shades (*Esox immaculatus*).

The spelling of the name muskellunge has been the subject of numerous modifications by various authors, with more or less etymological authority. Curiously enough the Cree Indian name sounds much like the French appellation (Henshall, 1892), but inasmuch as the orthographical representation of Indian sounds is somewhat a matter of individual interpretation, and as many North American French words have become greatly modified, if not wholly Anglicized, the spelling "muskellunge" is adopted here, as it is a phonetic representation of the common pronunciation whether by Cree or

<sup>a</sup> The branchiostegals are the riblike rays under the lower edge of the gill cover.

<sup>b</sup> Inasmuch as the distinguishing differences of these two species are very slight and the geographical distribution quite distinct, the easiest method of identifying them is by locality (see discussion of each). However, the following characters have been given in keys:

A. Head  $3\frac{1}{2}$  in length of body, snout  $2\frac{1}{2}$  in length of head, eye 5. .... *americanus*.

AA. Head  $3\frac{1}{2}$  in length of body, snout  $2\frac{1}{2}$  in length of head, eye 6. .... *vermiculatus*.

At least one student who has examined many specimens of each of these species maintains his belief that they are not distinct species, and are merely subject to local or geographical variations.

<sup>c</sup> "The muskellunge of Chautauqua Lake and the Ohio Basin differs greatly in appearance from that of the Great Lakes. As the two forms are not known to intergrade and as their habits are entirely distinct, they are best regarded as distinct species." (Jordan and Evermann, 1902.)

Frenchman. In fact, the Cree name may have been an Indianized form derived from French sources or vice versa.

The most generally known form of the spotted muskellunge is native to all the Great Lakes, the upper St. Lawrence River, Lake Champlain, certain streams and lakes tributary to the Great Lakes, and a few lakes in the upper Mississippi Valley, also in Canada north of the Great Lakes. It does not seem to be at all abundant anywhere, as the number taken each year in any one of the lakes is small. It is, perhaps, most common in Lakes Michigan and Erie and among the Thousand Islands (Jordan and Evermann, 1896).

The barred muskellunge is best known from Chautauqua Lake, though specimens have been reported from a few places in the Ohio drainage—for instance, in Lakes Conneaut and La Boeuf, Pa.; the Mahoning River, and the Ohio, at Evansville—and a young individual 8 inches long was found in 1899 or 1900 by W. P. Hay in Decker Creek, above Morgantown, W. Va. (Bean, 1902a).

The spotless form is found in a number of small lakes in northern Wisconsin and Minnesota. The following waters in northern Wisconsin are stated to be inhabited by this pike: Pelican Lake, Tomahawk and adjoining lakes, Arbor Vitæ, St. Germain Lakes, Trout Lake, the Eagle waters—i. e., a chain of lakes through which Eagle River flows—Three Lakes and others connected therewith, Buckatarbon Lake, Lac Vieux Desert, Big and Little Twin Lakes, Long Lake, Sand Lake, and various others, many of which have not been explored or named (Mosher, 1892, and Nevins, 1901).

#### SIZE.

The muskellunge has been stated to be the largest species of the pike family, but, if traditions and reports are true, in Europe the pike has attained a larger size than has ever been recorded for the muskellunge, and there are numerous records of pike in this country of fully as large size as the majority of large muskellunge. The average weight of the muskellunge and the usual range of the large pike perhaps are not much different except in some localities where the fish have become scarce and run large. In fact in the past there have arisen many disputes and discussions regarding fish which some anglers chose to call muskellunge and which others decided were pike. Sometimes the question was referred to the Sportsman's Journal and occasionally to the United States Fish Commission. Usually, however, the description of the fish was inadequate to permit of a positive identification.

The muskellunge has been said to reach a weight of 100 pounds or more (Jordan and Evermann, 1896), but the maximum weight is probably not often above 80 pounds and the average not over 25 or 30 pounds.



Bean (1902) stated that the muskellunge in Chautauqua Lake had been known to reach a weight of 50 pounds, and in the spring of 1895, when eggs were being collected for the Bemus Point hatchery, it was not unusual to take individuals weighing from 40 to 50 pounds and many weighing from 20 to 30 pounds.

At the Minocqua hatchery in Wisconsin James Nevins (1901) mentioned one of 40 pounds.

#### HABITAT AND HABITS.

*Habitat.*—Wherever the muskellunge occurs, its habits, so far as they are known, are essentially the same and generally similar to those of other members of the family.

The seasonal abode of the fish varies somewhat with the size of the fish. In any body of water it generally occurs in the vicinity of water plants at the edge of channels or streams or along the shores, where it lies concealed.

Referring to the Chautauqua Lake fish, Bean (1908) wrote that when the lake became very clear in February the fish go into deep water and that they live in deep water more or less all of the year, and in winter they frequent nearly the same localities as in summer, usually in the vicinity of water plants.

Mosher (1892) stated that the muskellunge delight to lurk among weeds or old tree tops that have fallen into the water. There they will lie for hours perfectly motionless.

Henshall (1892) stated that like all animals of prey it is solitary in its habits, lying concealed among the water plants and bullrushes at the edges of the streams or channels or along the shores.

*Feeding.*—The feeding habits of the muskellunge are essentially the same as of the other members of the family. As in the case of most predacious fishes, it subsists largely upon other fishes, for which it lies in wait under the concealment of water plants. Its size makes it a formidable engine of destruction, but not more so than other voracious species of like size.

Henshall (1892) stated of the muskellunge that, like all of the pike family, it is a typically piscivorous fish, having its large mouth, jaws, and tongue, armed with a terrible array of long, sharp, conical teeth of various sizes, which form veritable *chevaux-de-frise* from which there is no escape for the unlucky fish that is so unfortunate as to be seized by the cruel and relentless jaws. In another place he went on to say that the number of fishes destroyed by a mascalonge, as he called it, during a summer is almost incredible, and they are not small fry and young fishes, such as devoured by other predacious fishes, but those that have escaped the many dangers and vicissitudes of adolescence and have arrived at an age when they are capable of reproducing their kind.

*Spawning.*—In referring of the Wisconsin fish Nevins (1901) wrote: "The breeding places of the muskellunge are where the logs, stumps, and driftwood are thickest, in shallow water or flowage where dead limbs, logs, and brush have accumulated as results of flooding for logging purposes or otherwise."

Bean (1908) stated that the Chautauqua muskellunge begins to spawn a few days after the ice is out and continues until the latter part of April and that it spawns in comparatively shallow water from 10 to 15 feet deep. He said that the fish does not resort to gravelly bottoms like many other fish but to mud, usually going into bays.

The following communication <sup>a</sup> was reported in the proceedings of the Boston Society of Natural History in 1854:

Dr. Burnet (1854) stated on the authority of Prof. Ackley, of Cleveland, that the "muskalonge" (*Esox nobilior*) is known to perform an act of copulation in fecundating the eggs of the female. The female turning on her side offers her abdomen to the contact of the male, who, after taking a circuit, swims against her with considerable force. The female then retires and deposits her eggs in the sand, after which the process is repeated. Dr. Cabot thought that the object of the act in question might be to press the ova from the female just as they were about to be extruded. He has seen male and female suckers (*Catostomus bostoniensis*) side by side in close contact, during the breeding season, probably for a similar purpose. Dr. Durkee had noticed the same thing in the habits of the trout.

#### ARTIFICIAL CULTURE.

Only the State fish commissions of New York and Wisconsin seem to have made any determined effort to artificially propagate the muskellunge.

New York was first to undertake such operations, chiefly at Chautauqua Lake, and later Wisconsin carried on the work at the Minocqua hatchery.

In order to get the breeding fish, Bean (1908) stated, the pound nets are set at a number of places near Bemus Point as soon as the ice leaves the lake.

He stated that the males are smaller than the females and very little milt suffices to fertilize a large number of eggs. A female weighing 35 pounds yielded 255,000 eggs, and the eggs are about one-eleventh of an inch in diameter and 74,000 to the quart measure. They are semibuoyant and not adhesive.

Under favorable circumstances about 97 per cent of the impregnated eggs have been hatched. In the early experiments with artificial culture some eggs were hatched in 15 days with a water temperature of 55° F. The fry when first hatched are very small and quite helpless. The yolk sack is absorbed in about 15 days in water at 55° F.

<sup>a</sup> Note the similarity of this description with Smitt's and Benecke's statement relating to the pike.

Formerly the eggs were hatched in boxes, but at present they are placed in glass jars and hatched like whitefish eggs in artesian-well water with a uniform temperature of about 48° F. The embryos are too heavy to swim out of the jars, and therefore they are transferred at the proper state of development to trays in boxes placed in the hatchery troughs. These boxes are fitted with wire at each end to insure a direct and uninterrupted flow of water, which prevents the banking up of the fry at the lower end of the tray. Eggs first taken on April 18 began to hatch on May 16. The shell of the egg was very dark, almost black.

Premature hatching occurred on some occasions, due to a difference of temperature between the lake and the artesian water, a difference of 7° or 8° F. when the eggs were transferred. Cold water was found very bad for hatching the eggs. They do not develop properly, some having no shell when hatched and the fry small and weak. On the other hand, if hatched in warm water the fry would be black and strong and almost twice as large. The best water to use is lake water, which should grow gradually warmer.

Mr. William Buller, of Corey, Pa., hatched muskellunge eggs on the finest wire trout trays in water at a temperature of 45° F., where they were stated to hatch in 62 days into fine and healthy fry.

Muskellunge fry can be kept very easily until they begin to swim up, but after that the losses through cannibalism are so serious that it has been found impossible to rear them.

It does not, however, swim up as soon as the young of most fishes and is much affected by the quality of the egg. Sudden changes of temperature of the water injure the egg seriously.

Young muskellunge kept in a small creek, at the hatchery grounds at Bemus Point, grew faster than those in artesian water in the hatchery troughs and ponds.

Many attempts have been made to rear the muskellunge to fingerling size, but none has succeeded on account of the cannibalism so characteristic of the young.

The young fry are usually ready for planting about the end of May or in June.

The Wisconsin commission began to propagate the muskellunge during the spring of 1899 in connection with the work of collecting wall-eyed pike ova (Nevins, 1901). The chief difficulty encountered was stated to be to catch the fish on the eve of spawning, as it was found that the large fish would not stand confinement, and in the beginning sufficient ripe male fish could not be secured.

Attempts were made to hold the fish in pens and in a large dummy pocket 20 by 22 feet and 10 feet deep, but in vain. The ova would be retained in the fish and would cake. Finally, a large pen was made in a thoroughfare between two lakes in a current of water, in which

unripe fish were successfully held until the ova matured and both spawn and milt were obtained. After spawning the fish were released. In catching the fish for breeding purposes the fyke net is usually employed, and it is not altogether an easy matter to collect a sufficient number for spawning purposes, as the spawning places to which the fish resort in pairs are scattered about the lake. In transporting the fish to the pens live boxes 16 feet long, 2 feet wide, and 10 inches deep, made "skow-shape" with bottom of slats 2 inches apart, giving an abundant circulation, are employed.

Unlike those of most other fish the eggs do not harden after being taken from the fish, but remain soft and flabby until hatched. With the water at a temperature of 52° F. the eggs hatch in about 10 days, and about 15 days are required to absorb the food sack.

Both boxes and Chase hatchery jars were tried, with the result greatly in favor of the jars. Just before the eggs began to hatch they were taken from the jars and placed on fine wire-cloth trays, in order that the young fish might not smother, being unable to make their way out of the jars unaided on account of the comparatively large umbilical sack.

One female weighing about 40 pounds produced not less than 225,000 ova, 80,000 filling a quart measure and 190 individuals averaged 6,315 eggs each.

The fry when first hatched are a light color and seem to adhere to the side of the tank, box, or tray, or any other object with which they come in contact. Those hatched were strong and healthy, grew rapidly, and in their development exhibited their wild nature and the instinct of self-preservation by quickly darting off to hide when alarmed by a person approaching the tank in which they were confined.

They were retained until they were 4 weeks old and 1½ inches long and were fed upon young pike, which seemed to be suitable as well as acceptable food.

#### CONSERVATION.

Nevins stated that for many years, since the wilderness of northern Wisconsin was opened by railways and by lumbering operations, with the advent of the comforts and conveniences which the railroad takes into a new country and the encroachment of the settler and summer hotels on the primitive banks of our northern lakes, the pursuit of the muskellunge has been constant and relentless. Its utter extermination has been well nigh accomplished in many of our lakes where it was indigenous; and nearly all of our waters have been cleared of this fish to such an extent that its future has become a matter of much concern to sportsmen, fish culturists, and others interested in keeping our waters well stocked with superior game fishes.

Henshall (1892) stated that it is fortunate for the rest of the finny tribe that the "mascalonge" is comparatively a rare fish. The muskellunge, like others of the pike family, breeds in the spring, later, however, than the pike or pickerel. All of the pike family resort to overflowed marshes or shallow grassy streams to spawn—the pickerel during March and the muskellunge in May.

The pickerel thus has a start of about two months, and no doubt the young pickerel devour most of the muskellunge that hatch, for the spawn in May, in such shallow water, is exposed to the ravages of turtles, frogs, ducks, and coots, and most of it is doubtless destroyed. This seems to be a wise provision, for since the muskellunge spawns from 100,000 to 300,000 eggs, according to size, the result can be imagined were the same proportions of eggs to hatch and reach maturity as in the case of most other fishes.<sup>a</sup>

It has not seemed advisable to introduce this fish into other waters than those in which it is indigenous.

For a number of years the Pennsylvania commission has distributed the young of this species, hatched from eggs derived from New York waters, into natural muskellunge waters in Pennsylvania. One of the State reports says, however, that the muskellunge attains a size of 12 inches in a very few months, but to attain that size eats an enormous amount of food, causing it to be a dangerous fish to place in ordinary waters.

#### FOOD QUALITIES.

As in the case of other species of the family, opinions vary regarding its quality as a food fish. Henshall wrote (1892) that in comparison with the rest of the family it is a valuable food fish, though it is much overrated and is inferior to the whitefish, lake trout, black bass, or brook trout for the table, but that it is, however, readily disposed of in the markets, and, while possessing no special or characteristic flavor, is firm, flaky, and is much admired by many, and adds "but chacun à son goût."

On the other hand, Nevins (1901) stated that from a gastronomic standpoint the muskellunge has few equals among fishes and by some is considered to rank in quality next to the salmon.

#### AS A GAME FISH.

Henshall (1892) stated that as a game fish the "mascalonge" is far superior to the rest of the family, and when weighing upward of 10 pounds its great vitality, weight, and power give it an endurance that

<sup>a</sup> In this statement Henshall does not seem to recognize that homologous adaptations exist in other fishes. In natural economy the purpose of reproduction—i. e., the perpetuity of the species—is accomplished by the survival of one pair only to replace the parents when they are gone, and for which purpose one species is no better equipped than another. Every species is naturally adapted to meet both favorable and unfavorable conditions to which it is naturally subjected. The species which is subjected to the most adverse conditions has the most eggs, and vice versa.

is highly extolled by some, but can hardly be compared to the salmon, black bass, or brook trout for pure gameness per se; that is, it does not exhibit the finesse and élan of those superb game fishes.

Most "mascalonge," however, are taken with hand line and trolling spoon and hauled in hand over hand. With taut line and moving boat the "mascalonge" sometimes leaps above the water because it can not get very far beneath the surface. As a rule, however, when on the rod it does not leave the water and will not leap unless forced to do so, but will endeavor to keep near the bottom or to reach the cover of weeds or rushes.

With proper tackle the "mascalonge" affords good sport, for, being a powerful fish, it requires much skill and judgment on the part of the angler to keep it away from the moss and grass bottom or from the weeds and algæ of the shore and to successfully bring it to gaff within a reasonable time. The best bait is a large live minnow or frog, either for casting or trolling, though for the latter mode of fishing a large trolling spoon with single hook may be used.

Regarding the Ohio fish, Henshall said that in the Ohio and its tributaries the "mascalonge" is found in the summer and autumn in the deepest holes of the streams and are then taken by stillfishing, the bait being usually suckers of a half pound or more in weight. After taking the bait the fish is given time to gorge it before striking or hooking. He adds:

It is now, however, a rare occurrence to take a "pike," as it is called, in these waters, and the fact is talked of long afterwards and the head preserved as a trophy, while the fish itself, being esteemed a great delicacy on account of its great size and rarity, is made the piece de resistance of a formal dinner instead of being preserved for a piece justificative. For five years I have endeavored to procure a specimen of this rare fish in the Ohio Basin, but, beyond the head, my efforts have so far failed. No one who is so fortunate as to capture a "pike" seems willing to part with it for love of science or coin of the realm.

Regarding its game qualities, Mosher wrote that when lying basking in the sun they rarely take bait unless unusually attractive, but when lurking in the weeds or rushes, waiting for some living victim, they will take artificial bait voraciously. But, he stated, they do not seem to be so voracious as their smaller cousin the pickerel, and there are times when for days together no amount of coaxing will induce them to take bait of any kind.

#### PIKE (*Esox lucius*)

The pike, as previously mentioned, is the only species of the family which occurs outside of North America. Its geographical range, according to F. A. Smitt (1892), is from northeastern Siberia west to the east of North America. According to Pallas, it inhabits the River Amur, which falls into the Sea of Okhotsk, and the Rivers Indigirka and Chatauga, which discharge into the Arctic Ocean,

but is wanting in the Kamchatkan Peninsula. Brehm found it in the lower course of the River Obi; and in the great lakes of the Barbara steppes (the upper basin of the Obi and Irtysh) it is extremely common; according to Pallas, and attains a considerable size. It occurs also in the Caspian Sea but not in Transcaucasia or in the Black Sea, though it is found in the Sea of Azov and the basin of the Danube. It is met with in rivers and lakes throughout Russia and north-central Europe, including Great Britain, Italy, and Sicily, but is said to be wanting in Greece and on the Pyrenean Peninsula. It inhabits all the waters of Scandinavia, with some exceptions in Norway.

In North America its range extends across the continent from the Labrador Peninsula to Alaska, northward to beyond the Arctic Circle, and southward to the St. Lawrence and Great Lakes Basin. It is found also in some waters in the United States south of the Great Lakes, as northern New York and the Mississippi and its tributaries,



FIG. 3.—COMMON PIKE (*Esox lucius*).

but it does not occur in Nova Scotia, New Brunswick, or (except by introduction) in that part of New England east of the Green Mountains.

It is the common pike of northern New York and the States bordering on the Great Lakes.

Chambers (1896) stated that it occurs in Lake St. John and its tributary streams as well as in the large lakes adjacent to and beyond the height of land.

According to Low (1895), this fish is found abundantly throughout the interior of Labrador in the lakes and quick-flowing streams and is common in the rivers of the southern, eastern, and western watersheds, but not abundant in the Koksoak River.

Preble (1908) reported that it is abundant in the Mackenzie Valley in practically all the waters of the region and has given its name to scores of lakes and streams, but he was unable to ascertain its presence in the Ark-i-link, Great Fish, or Coppermine Rivers. However, it is an inhabitant of the Anderson.

Bean said that Townsend and others found it above the Arctic Circle in Alaska, and Dall and Nelson took it in abundance on the Yukon.

## NAMES.

In America, as in Europe, this fish is known by various names according to locality and appearance. In the British Isles the young is called a "jack" or, sometimes, pickerel. In our own country, probably, the name pickerel is in as common use for this fish as pike, and, intentionally or unintentionally, when large it has sometimes been mistaken for muskellunge. It is the "grass pike" of Lake Erie and perhaps of other waters. In Canada it is referred to as pike and jack pike. According to Forbes (1908), in Illinois and elsewhere it is called pickerel. However, with a little scrutiny, at whatsoever size, it can hardly be mistaken for any other species. The presence of scales on the cheeks and absence of any on the lower half of the gill cover easily distinguish it.

While the color of the fish may vary considerably in some details of shade or markings, as usually observed it may be said to be greenish gray with yellow reflections and with many white or yellow spots arranged somewhat in rows, the dorsal and caudal fins bearing round or oblong black spots. The young are more or less crossbarred.

## SIZE.

While the muskellunge is stated to be the largest of the pike family, in Europe, if traditions can be believed, the pike has far exceeded any muskellunge record. One taken at Bregenz in 1862 was said to weigh 145 pounds, and one caught in Scotland was reported as being 7 feet long and weighing 72 pounds.

Smitt (1892) said that the maximum authentic record is one of 57.2 pounds, but that pike of that size are of rare occurrence.

Jardine (1896) presented lists covering a period from 1869 to 1896, inclusive, of large pike taken by anglers in England, Scotland, and Ireland, comprising 51 examples ranging from 18 to 37 pounds, which are found to average  $25\frac{1}{8}$  pounds. He mentions another found after draining Whitlesea Mere which weighed 49 pounds.

Coupled with the alleged great size to which the pike has attained in Europe are unauthentic accounts of instances in which individuals reached a great age, as high as 200 years in some cases.

In a large lake at the head of a tributary of the Nushigak River, Alaska, the Inuit natives believe that there are pike of fabulous size which they hold in a sort of superstitious awe or fear and concerning which they relate wonderful tales, believing that they attack men in their kyaks and devour them. They say they are longer than a kyak (Fassett).

In some waters of British America the pike reaches a considerable size. Preble (1908) stated that in the larger lakes it attains a weight of 35 pounds or more. In Labrador Low (1895) said that it varies in weight from 2 to 15 pounds.



According to Chambers (1896), in the Lake St. John region many of them far exceed in weight the generally accepted limit of size of the ordinary *Esox lucius*, sometimes attaining the weight of 20, 30, and even 40 pounds. One was taken in Lake Tscho-tagama in 1890 which weighed 49 pounds and another in 1891 of 47 pounds. In 1892 one was caught in the Peribonca River which weighed 35 pounds.

Herbert (1849), referring to the pike, said that specimens of the northern pickerel may be found which weigh as high as 16 or 17 pounds, but that weight is rarely exceeded.

Forbes (1908) stated that the average weight of the pike in Illinois waters is not over 5 pounds, but a specimen weighing 26½ pounds was reported by Dr. Jordan to have been caught in the Kankakee, and Tomlin (1892) wrote that specimens have been taken in Michigan and along the bays connecting with the north shore of Lake Superior which weighed as high as 20 pounds.

#### HABITAT AND HABITS.

*Habitat.*—The pike chooses its spring and summer haunts by preference in shallow inlets with weedy bottoms and shores overgrown with reeds and rushes. Toward autumn it betakes itself to precipitous, stony shores, which it again forsakes when winter is at hand and the inlets freeze. Most of the pike then return to their summer stations, but the larger ones seemingly follow the shoals of other fishes to the depths, being seldom caught during the winter in shallow water. For these a more plentiful supply of food is, no doubt, necessary than shallows afford in winter. When the pike has chosen its station for the season, it restricts its wanderings to the immediate neighborhood, leading a solitary life and never being seen in company except during the spawning. (Smitt, 1892.)

According to Preble (1908), in the far North it is much less common in the muddy rivers than in clear lakes, and the pools at the foot of falls or rapids are favorite haunts. Forbes (1908) said it prefers clean, clear, cool water with a sluggish current, in which it remains generally quiet by day.

*Habits.*—Tomlin (1892) wrote:

It is a powerful fish and is no coward; it will fight as viciously as a terrier. We have seen small pike with jaws locked and lashing the water around them like a boiling caldron. Occasionally letting go and backing out, they would rush at each other with open jaws and keep up the fight until one is beaten and driven away or until later on exhausted. Some years ago I found two dead, with both jaws fast set so that they could not be pulled open. Both of them were handsome male fish and must have fought fiercely, for their bodies were cut all along the sides and bellies.

*Feeding.*—The pike is undoubtedly the most voracious among the fresh-water fishes. It devours indiscriminately other fishes, young waterfowl, small mammals, and carrion. From the dense bed of grass or rushes, where it usually passes the day in stationary watch,

it pounces with the speed of an arrow on its unwary victim. It almost always seizes its prey crosswise and retains its hold until the latter is dead or so exhausted as to desist from all struggles. Then the pike turns the prize in its jaws till the head points toward the interior of its mouth and commences its meal. This operation is a protracted one when the victim is large, for the end first swallowed and received in the stomach must digest to make room for the remainder (Smitt, 1892).

On one occasion a pike of 7 or 8 pounds' weight was seen to dart forward and seize a salmon which was quite as large in its formidable jaws right across the body. The combat was fierce. The salmon leaped out of the water and made desperate but fruitless struggle to shake off its relentless captor. In a couple of hours' time the salmon was utterly exhausted, and the pike began to swallow it head first. The meal lasted three days before the whole body had disappeared. The process of digestion must have taken much longer, for all the following week the pike had a very swollen appearance and could hardly be induced to move by touching it with a long stick (Smitt, 1892).

The fishermen in general believe that at certain seasons of the year the pike entirely abstains from food and at others is excessively voracious. These seasons are said to be periodical and regular in occurrence, the observant fisherman being able to predict the time when the pike is "on its feed," as it is called. But these periods are said not to occur at the same time year after year, and according to some observations, they are determined by the spawning season, for the period of voracity begins in the same change of the moon (waxing or wane) as the pike finishes spawning. There is one exception, however, the pike being always "on its feed" throughout the dog days. This periodical voracity and moderation is said to depend on the circumstance that at certain times the points of the teeth hardly project above the flesh, some tenderness of the gums being thus the curb of the pike's usual rapacity. Perhaps we have here some observation on the manner in which the pike casts its teeth or we may find a more probable explanation in the fact that the fish requires some time to digest the great quantity of food which it devours during the period of voracity (Smitt, 1892).

According to Chambers (1896), in the Lake St. John the fish is so voracious that many of the settlers about the shores fear to bathe in the waters. Both dogs and waterfowl swimming upon the surface have been attacked.

Forbes (1908) stated that it is purely carnivorous, its food consisting of fishes, such as sunfish and black bass. Frogs, crayfish, large water insects, mice, reptiles, and young ducks have been reported by various authors to have been taken from the stomachs of pike.

*Breeding.*—Since, unfortunately, not much has been written concerning the breeding habits of the American pike, it is again necessary to rely for information mainly upon what has been published respecting the European fish. However, if the two are specifically identical, the general habits are probably much the same.

Smitt (1892) has quite fully described the spawning process of the Scandinavian pike, and his description essentially agrees with the account of the German fish given by Benecke.

In the spring before there is open water in the lakes the pike commences to approach the shores, and breeding individuals in particular repair to those parts of the shore having inlets. When the spring is so far advanced that the lakes are free of ice, the brooks clear, and the low-lying meadows about the shores are under water, the larger pike make their way to those inundated places and begin to spawn.

The spawning is of long duration, its season depending upon the age of the fish, the young spawning first. When they have finished, the middle-sized pike begin, and the oldest and largest spawn last of all. Generally there are laid about 100,000 yellowish eggs about 3 millimeters in diameter, out of which in the course of 14 days the young with their great umbilical sacs escape. The spawning time in eastern Prussia was given as during the months of February to April, and occasionally the spawning of the first pikes occurs before the departure of the ice. (Benecke, 1880 and 1885.) In Illinois the pike spawns in March, selecting shore water about a foot and a half in depth, and the young hatch in about 14 days (Forbes, 1908).

Benecke (1880 and 1885) stated that it lives a hermit life, consorting in pairs only during the spawning season, but Smitt said that the females, which are always larger, come to the spawning places each attended by two or three or, in rare cases, four males; also that the females swim so high in the water that when the weather is calm the surface is faintly rippled by their movements and the dorsal and caudal fins may be seen above the surface. As soon as the female halts the males approach and surround her, one on each side or, if more than two, one under the tail and perhaps one above the back. They rub themselves against her body, during which operation she keeps still, only moving the fins, after which she disperses the males with a sudden lash of her body and darts to another point, meanwhile having deposited in the grassy bottom the yellowish and coarse-grained roe which is impregnated by the milt. At the new location the operation is repeated. Benecke, however, states that the fish rub violently against each other and the spawn is deposited, accompanied by powerful blows of the tail.

The number of eggs yielded by a pike, of course, depends upon the size of the fish. Pennel (1886) stated that a pike produces about 80,000 eggs, while Jardine (1898) placed the number at 100,000. Bloch counted in a pike weighing a little over 6 pounds 136,500 ova,

and Buckland found in a female weighing 28 pounds 292,320 eggs and in another weighing 32 pounds 595,200 (Smitt, 1892).

According to Smitt (1892), the eggs, which at first are rather adhesive, lie free on the bottom and in the spring (April) require about three weeks to hatch. Jardine says that the period extends from one to three weeks according to the temperature of the water.

Notwithstanding the great fecundity of the pike, Smitt was of the opinion that a great portion of the deposited roe is probably destroyed, committed as it is to the open waters, where it is exposed to many dangers.

The newly hatched fry, wrote Sundevall (Smitt, 1892), is short and thick in shape with rather a large belly. The coloration is yellowish but quite transparent and densely punctated on the surface with black dots, a dark band running from the eyes along the sides of the belly.

At first the larva remains almost quiescent, lying close to the surface of the water beside plants and floating straws and the like, to which it seems, as it were, to hang, or else at the bottom in less than an inch of water. On being touched it swims rapidly about with hasty movements of the tail but soon resumes its former position. In about 10 or 11 days the yolk is absorbed and the belly much reduced in size but the head elongated and the mouth large. It now begins at once to swim more steadily, in the same manner as its elder, and goes in quest of prey. It soon abandons the habit of lying on the bottom or resting alongside floating objects, repairs to somewhat deeper water, remaining for the most part stationary, as if on the watch for prey. It seizes small fishes and other aquatic animals of a size considerable enough in comparison with its own, but only leaps for those which it sees moving, just as in the case of older pike (Smitt, 1892).

#### RATE OF GROWTH.

According to Smitt (1892), the external form in which the specific characters of the pike may be traced seems to be fully developed at an age of nearly 2 months and a length of about a Swedish inch (25 mm.). Subsequently the growth proceeds rapidly, as usual, at first, but with very considerable variations, depending on the different supply of food under circumstances favorable in all respects. According to some observations a 1-year pike is only 15 centimeters long, according to others 30 centimeters. Blanchere states the growth as follows:

#### MAXIMUM LENGTH OF THE PIKE.

	Meters.
1 year old.....	0.25-0.30
2 years old.....	.36- .42
3 years old.....	.55- .60
6 years old.....	1.00
12 years old.....	1.35

How widely such computations may differ appear from Ekstrom's observations. He found that pike fry 37 to 49 millimeters (about 1.45 to 1.90 inches) long, kept in a spring with muddy bottom, only attained in 5 years the size of a common herring, but that a specimen 15 centimeters (about 5.88 inches) long, kept in another spring with smaller fish to feed on, attained in 5 years a length of 4 decimeters (about 15.70 inches).

Whitmark gave a number of statements from authorities in different parts of Germany showing the annual rate of growth of the pike, which appears to vary from 2 to 3 pounds, the maximum size attained being from 40 to 70 pounds. He cited one instance in which, in two summers, a few individuals liberated in a pond full of a species of carp grew from the weight of  $1\frac{3}{4}$  to that of about 10 pounds.

Frank Buckland was of the opinion that pikes did not become egg-bearing under the weight of 3 pounds (Jardine, 1898).

#### CULTURE AND CONSERVATION.

Notwithstanding its growing scarcity, the idea of any need of culture or conservation appears not to have been generally entertained. Apparently no attempts at artificial propagation have been made.

In the words of Forbes (1908), this noble fish, completely and almost ideally equipped for the predatory life, has now nearly disappeared from the larger and muddier streams of Illinois, but it is still found in abundance in the headwaters of the Kankakee and in the small glacial lakes of the northeastern part of the State.

Chambers (1896) regarded it as fortunate that in many of the Lake St. John waters, where it has been systematically fished during recent years, the pike is very much less abundant than formerly.

In New England, about 1838, the fish, it seems, was transplanted from Lake Champlain into a pond connected with Black River, Windsor County, Vt., and thence carried by a freshet into the Connecticut River. In 1846 Dr. Storer (1848) reported the capture of this species in the Connecticut River, a specimen having been sent to him by Mr. William Henry, of Bellows Falls, Vt. Mr. Henry reported that he had known, in some seasons, 100 or more to be taken at Bellows Falls, weighing from 1 to 14 pounds each.

There are probably other instances of its having been transplanted, but its artificial propagation has not been encouraged in this country. However, regarding the British pike, Jardine (1898) wrote that inland lakes, ponds, and brooks were lying useless and pike would well repay cultivation in them, for they grow and fatten with great rapidity.

#### FOOD QUALITIES.

As a food fish the pike is of no small value. The flesh is white, firm, wholesome, and comparatively free from bones. Fresh pike is by no means a bad dish, and the flesh has advantage over that of

many other fishes. It may be kept for a long time, without deteriorating, in a salted or dried condition.

Herbert (1849) said that it is coarse, watery, and of small value on the table.

Preble said (1908) that in the Athabasca and Mackenzie region, a region of excellent food fishes, it is not highly esteemed, but being easily captured it is often a means of preventing much suffering from famine.

Benecke (1880 and 1885) stated that only the young rapidly growing pikes are edible, the old ones being dry and tasteless.

Jardine (1898) cited the "Analysis tables of the food collection" at Bethnal Green Museum in support of his statement that the pike is a nutritious food, containing more nitrogenous or muscle-forming qualities than meat, and he added that as an adjunct to the domestic bill of fare a small pike from 5 to 8 pounds' weight, caught during November or the next three months, when fat and nicely cooked, is a dish by no means to be despised.

#### AS A GAME FISH.

Go where pike can be found, fish for them with legitimate tackle, give them a fair chance, and they will afford as much pleasure as any royal smallmouth bass that ever swam (Tomlin, 1892). Cheney (1896) wrote that the pike and pickerel had not been hatched in this country, but that the pike was cultivated in Germany by artificial methods and is regarded more highly in Europe than in this country. He explained that the reason for this is that we have such a great number of so-called game fishes considerably superior to the pike that the latter has been relegated to an inferior position. However, the pike has its loyal adherents who regard it highly as a rod fish and as a table fish.

#### EASTERN PICKEREL (*Esox reticulatus*).

The eastern pickerel has a comparatively limited natural geographical distribution. It is believed originally to have been restricted to the fresh waters of the Atlantic seaboard, being commonly found everywhere east and south of the Allegheny Mountains from southwestern Maine to Florida.

Aided by man its range has been extended throughout the southern half of Maine and even farther north into the lower waters of the St. John River, into New Brunswick, and elsewhere. Thompson (1842 and 1850) did not record its being found in Lake Champlain, but stated that it was the common pickerel on the east side of the Green Mountains, as *Esox lucius* was on the other.

However, it has since been reported in Missisquoi Bay (Evermann and Kendall, 1902) and in the St. Lawrence as long ago as 1863

(Fortin, 1864). It has also been recorded in one locality in Lake Ontario (Evermann and Kendall, 1901).

Occurring as it does so commonly in the St. Lawrence, it is peculiar that it is not more common in the northern tributary waters, but Halkett (1913) does not definitely record it at all, and Nash (1908) states that he has not met with it elsewhere than in the neighborhood of Toronto, where he has taken a few specimens.

#### LOCAL NAMES.

A common book name given this pike is chain pickerel, but in New England it is almost if not quite invariably known as pickerel. It is, perhaps, the grass pike of the St. Lawrence and the green pike of some other localities. It is commonly called jack in the south, the term being probably an early importation from England, where small pike are often so denominated. Smith (1907) mentioned pike, red-

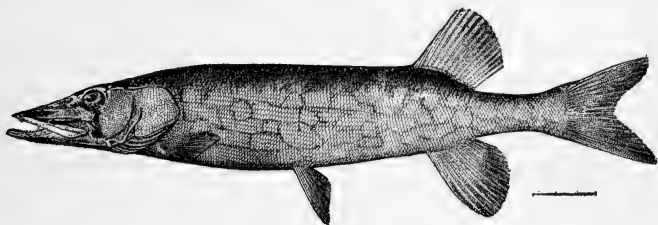


FIG. 4.—EASTERN PICKEREL (*Esox reticulatus*).

finned pike, black pike, duck-billed pike, and jack as names in common use in the Albemarle region of North Carolina. He explained that old specimens living in deep, shady water were designated as black pike by the commercial fishermen. Bean (1902) said it is the federation pike of Oneida Lake, N. Y.

#### CHARACTERISTICS.

The scales on the cheeks and opercles easily distinguish this fish from the muskellunge or pike, but not from the other two species of pickerel. From these the adult may be always distinguished by the reticulated black or brownish lines on the sides. Younger fish do not show these marks, but are also banded, the cross bands being wider and, consequently, fewer than in either of the others. The structural distinguishing characters have already been indicated. A well-conditioned pickerel, with its green and golden hues and dark markings, is a beautiful fish.

#### SIZE.

Ayres (1844) gave an account of phenomenally large examples. He said that on February 28, 1842, he examined a pickerel which had been caught in the Hockanum River, about 2 miles east of Hartford,

Conn., which he claimed was "an undoubted *reticulatus* of Le Sueur." It was 38 inches in length and weighed 14 pounds. He stated that this was the largest example of the species which had ever come under his observation with one exception. The largest of which he had ever heard as occurring in the Eastern States was taken in the spring of 1842 near Greenfield, Mass., which weighed 20 pounds. These might be accepted as authentic records were it not for the fact that the introduced pike had become fairly common in the Connecticut River in 1846 in the vicinity of Bellows Falls, Vt., and had found its way down perhaps into these tributaries. This fact lends an element of doubt to the question, preventing acceptance of the records as authentic, although Dr. Ayres was an accomplished ichthyologist. However, ichthyologists have been known to make worse mistakes.

Storer (1853) said that the largest pickerel seen by him were specimens weighing 7 pounds brought from Brewster, Cape Cod. Even larger ones were reported to have been found there.

Pickerel weighing as high as 8 pounds have been authentically reported, but such size is uncommon and fishes accounted large will not usually exceed half that weight. Two and three pound pickerel are about the average in waters of ordinary suitability to the fish. However, bodies of water differ in respect to their suitability, and in some the largest fish will not exceed a pound and in others much larger fish are common.

#### HABITAT AND HABITS.

*Habitat.*—The usual haunts of the pickerel are weedy streams and bays or coves of lakes. In some lakes small and medium sized pickerel occur in the shallow coves, where they lurk under lily pads or amongst the rushes and sedges. Often larger fish occur along rocky shores contiguous to deep water, especially if there are fallen trees, brush, or boulders to afford concealment. It has, also, been caught on the rocky shoals of an open lake.

In some streams, while it is most abundant in the sluggish, dead waters where aquatic vegetation is profuse, it is not infrequently found well up in quicker water if the character of the shores or growth there provides concealment.

In North Carolina, Smith (1907) stated that its favorite haunts are creeks, coves, and bayous containing grasses and broad-leaved water plants, under which it lurks.

Where natural or artificial obstructions do not exist, the pickerel will sometimes make its way to extreme headwaters. Adult pickerel a foot in length have been taken near the spring source of a stream where it was not over 2 feet wide and only a few inches deep, but full of pondweed. However, pickerel will not often traverse rapids or long extents of rips, and those found far upstream, as just de-



scribed, probably reached those places for self-protection while young fish. The very young, just as in the case of many other fishes, find their way into the shallowest waters and mouths of brooks entering the lake, probably from neighboring localities where they were born.

According to Mr. Frank Todd, of St. Stevens, New Brunswick,<sup>a</sup> a few years after the introduction of pickerel into the St. Croix Lakes, for a number of years a good many individuals of large size were taken by weirs and by hook in salt water some 6 or 8 miles below the head of tidewater. At the time of writing, however, some 15 years since the introduction of the fish into that region, they had greatly decreased coincidentally with the pickerel of the fresh waters.

*Food and feeding.*—The principal subsistence of adult pickerel consists mainly of other fishes, although it includes many other animals in its bill of fare, such as frogs and other batrachians or, in fact, any living thing moving in the water within reach which it can capture and handle. According to Smith (1907), in the spring about Albermarle Sound, this fish feeds chiefly upon alewives.

Like other members of the family, this pickerel is accounted an extremely voracious and destructive fish, but it is seldom found gorged with food, as is the salmon and trout, although it sometimes proves itself successfully ambitious respecting the size of the object it swallows—swallowing, as it were, on the installment plan. When ravenous, it does not hesitate to seize a fish at least half as large as itself or so large that a portion of the fish may be seen protruding from the pickerel's mouth as the remainder is being digested in the stomach. In Umbagog Lake, of Maine and New Hampshire, of numerous pickerel examined, those that contained any food at all usually had small suckers. Three pickerel—11, 12, and 15½ inches long—caught in a stream in the vicinity of Freeport, Me., contained only aquatic insect larvæ. A 2-pound pickerel caught at the mouth of Sebois River, a tributary to the east branch of the Penobscot in Maine, contained a hornpout (*Ameiurus nebulosus*) about 4 inches long, and in one weighing 2½ pounds, taken in the Wissatoquoik Deadwater of the east branch, was found a smaller hornpout.

The character of the food of young and adolescent pickerel may be inferred from the following examples: At Sebago Lake two pickerel about 2½ inches long each, contained small insect larvæ and small crustaceans, and one about 5.8 inches in length had only a tiny fish in its stomach. One less than 2.5 inches long contained a young sucker, apparently partly digested, about one-half an inch in length. One about 3.2 inches in length contained one sunfish (*Lepomis gibbosus*) about nine-tenths of an inch long, swallowed head first, and one 4.7 inches in length had fed upon nothing but insect larvæ

<sup>a</sup> Forest and Stream, vol. viii, June 21, 1877, p. 320.

and amphipods, small crustaceans very common in the brook in which the fish were found. At Umbagog Lake many young pickerel ranging from 2 to 4 inches long were found to be feeding exclusively upon Entomostraca and insect larvæ.

Of eight examples, from 4.25 to 6.37 inches in length, caught at the same time and in the same place, six contained fishes, four of which were young pickerel. Of another lot a 4.25-inch fish had also a young pickerel 3 inches long in its alimentary tract; one 5.37 inches long also contained a pickerel 3 inches long; another 5.87 inches long, besides other things, had a pickerel 2.06 inches in length in its stomach; still another 5.62 inches in length contained two small minnows; one 6.37 inches long had in its stomach one pickerel 3 inches long and one shiner 2.5 inches in length; and another 7.5 inches long contained a 1.5 inch hornpout. Other instances were those in which one 7.5 inches long contained the head of a small chub and one 9½ inches long had a 2.3 inch pickerel in its stomach.

The foregoing suggests a cannibalistic tendency even in very young fish, which is maintained throughout life owing to the previously mentioned fact that, when feeding, the pickerel will attack any accessible moving object. Pickerel, however, are not always feeding, and apparently go without feeding for periods of days, or at least, during the time in such periods as they are under observation. Probably, its hunger having been satisfied, like many other fishes, it refrains from eating for a considerable period. When it takes its food it does so with a rush, and if the food is a fish the pickerel grasps it crosswise, then stops and works its victim around so that it is swallowed head first.

*Breeding.*—The breeding places of the pickerel are shallow coves, mouths of inlets, approaches to outlets, and sometimes in overflowed areas, in water from 3 to 10 feet deep, but not always in the same places each year. Sometimes the eggs are deposited among the roots of submerged tree stumps, the branches of fallen trees or bushes, water plants, and occasionally on gravel or in the crevices among rocks. Here, according to Tomlin (1892a), the fish are found in pairs, gently swimming to and fro, rubbing side by side until the female is ready to spawn. Similar to the perch, the eggs are laid in glutinous strings of a yellowish-white color, which often form large masses and have been seen clinging to submerged bushes in great mats or long strings. Strings of pickerel eggs observed by the collector of the Pennsylvania Fish Commission (1907) were said to average from 2 to 9 feet in length. Most published statements regarding the spawning time of pickerel are rather indefinite, as in "winter and spring." It is quite possible that southward it does spawn in late winter. However, the report of a commissioner of Massachusetts (1870) stated that Mr. Stone found

the pickerel ripe in the beginning of May. In Pennsylvania they were found to begin to spawn from the middle of April until the early part of May, depending upon the locality and season.

The female fish appear to preponderate over the males, according to observations cited by the Massachusetts Fish Commissioners (1870):

This fish, to its other disagreeable and contrary qualities, adds the tendency to multiply females, whereby the spawn crop is increased. Among many individuals examined last spring it was rare to find a male, not oftener, certainly, than 1 in 14.

#### RATE OF GROWTH.

The rate of growth of the pickerel, like that of any fish, depends much upon the available food supply and to some extent upon the temperature of the water. Tomlin (1892a) said that as soon as they are able to take care of themselves they show the family likeness and begin their bold predacious attacks upon the fry of the silver chub and shiner family.

The Massachusetts Fish Commission reported (1870) that its rate of growth seems to vary with the temperature. In a pond fed by a large spring brook, when there was enough food but cold water their growth seemed slow. In support of the statement the following table was given:

Age.	Length.	Weight.
	<i>Inches.</i>	<i>Ounces.</i>
1 year.....	4.5	0.5
2 years.....	7	1.5
3 years.....	10	4
4 years.....	13.5-14.5	8-12
5 years.....	17.5	24
6 years.....	20	40

On the other hand, it was stated that in a large warm pond, covered with lily pads and full of young alewives, pickerel have reached 4 and 5 pounds in three years.

#### FOOD QUALITIES.

As a food fish it is variously esteemed, by some being regarded as an excellent fish and by others as decidedly inferior. In regard to this, it may be said that much depends upon conditions. A pickerel of moderate size from fresh cool water is not to be compared with one that has lain all day in the sun or a week or two in cold storage or a day or two on the market stand.

Storer (1853) said: "This fine species is the common pickerel of Massachusetts \* \* \* and is everywhere valued."

Bean (1902 and 1902a) said that as a food fish not much can be said in praise of the chain pickerel, though it is eaten by some and

liked by a great many people, and, again, that in some parts of New York it is little esteemed, but in other portions of the State it is considered a fairly good fish and furnishes sport for the angler.

Whatever its food qualities, it is persistently sought throughout the year in localities where no restrictions are placed on the fishing and everywhere throughout the prescribed open season and is a common fish in some markets of the East and South. Smith (1907) stated that in North Carolina considerable quantities are marketed, but it does not rank high, the flesh being coarse and filled with minute bones.

In the writer's experience the pickerel has always been found to be an excellent fish when fresh from Maine waters and properly cooked. While small fish might be objected to on account of bones, he has not found them more troublesome in that respect than in many other small fishes.

#### PROPAGATION.

It appears that only the Fish Commission of Pennsylvania has ever considered the pickerel worthy of artificial propagation. Attempts were made in that direction as early as in 1901, but it was not until about 1905 that much success was attained. The reason for the attempt at artificial propagation of the pickerel is stated in the annual report of the commissioner (William E. Meehan) for 1905, pages 57-59 (1906) as follows:

Between 40 and 50 years ago nearly all the sluggish waters in eastern Pennsylvania teemed with pickerel, especially the streams near the border line of New Jersey. Three-fourths of the natural mountain lakes also contained large numbers of this fierce but excellent food fish. The pickerel in the streams were soon wiped out, so that 25 years ago it was rare to find a pickerel in any of this type of water, except occasional "strays." With very few exceptions there has been a rapidly diminishing supply in the mountain lakes. Destructive methods of fishing undoubtedly have been the one potent cause for this marked reduction, another was that no efforts were made to restock.

At first vain attempts were made to retain pickerel in ponds or pens until they became ripe and to retain them afterwards as breeders, but it was found impossible to supply them with the required living food. Therefore, they began to search for their eggs where the pickerel had deposited them naturally. These were collected and conveyed to the hatchery, where they were placed in hatching jars. At first the Downing jar was used, but later one devised by the commissioner himself, which was found to be more effective. The jars were arranged in the form of "batteries," as in the case of whitefish or perch.

It was stated to have been found to be remarkably easy to hatch pickerel eggs, as only a very small flow of water was required. However, constant vigilance day and night was necessary, for as soon as the

eggs began to eye they became semibuoyant and often bouyant, and unless prevented the eggs would have flowed out of the jars into the troughs and been lost. This the whole batch was liable to do in a few minutes. The flow of water through the jars must be barely enough to slightly move the eggs. It was in permitting this gentle flow that the Meehan jar was an improvement over the Downing jar, which required considerable force of the water to operate.

Although a strong flow of water was impracticable and a light flow necessary, the latter had to be augmented by some stirring of the eggs in order to prevent their smothering just before the hatching period. This was accomplished by occasionally rotating the glass tubes that supplied the water, thus producing better circulation and a change of position of the eggs.

The eggs were found to hatch in about a week or 10 days, varying somewhat with the temperature of the water, and were found to hatch equally well whether they came into the station clean or dirty. It was found that it was very injurious to attempt to wash the eggs when brought in. They had to be placed in the jars together with what sticks, weeds, etc., were clinging to them. At first in transporting the eggs from the lake to the hatchery cans were used, but later the eggs were retained in floating boxes until the conveyance came for them, when they were packed in egg cases and carried to the hatchery.

It seems that after 1910 pickerel propagation practically ceased in Pennsylvania. To indicate, however, the magnitude to which it had attained at that time, it may be said that in 1909 there were distributed 300,150,000 pickerel fry and the number in 1910 amounted to 226,100,000. In 1914 the only distribution of this species was 85 adult fish.

#### CONSERVATION.

In some States the pickerel has always had more or less nominal protection of the law. In some, perhaps it may be said in most, communities pickerel fishing has been a favorite pursuit of local residents, particularly in winter, both for the sport and for their tables. In the North pickerel was formerly caught to some extent for the market. However, in all localities there have been those who derogated the fish to the lowest degree. These were usually anglers who preferred other fish and fish culturists who believed that to all the allegations regarding its rapacity and destructiveness much more that had not been said could be added were their language adequate. Even to-day fish culturists have inherited the ancient beliefs and antipathies against the pickerel, which were based upon a small amount of truth and a great amount of fallacy.

But there have always been and still are those who want pickerel fishing and demand its protection and some who have wanted and those who now want the fishing without the protection. Some of

these facts are at the bottom of stated antagonistic beliefs and recommendations. The intricacies in politics involve even the fishes of the waters. One State fish commissioner's report calls attention to "much dissatisfaction regarding ice fishing. Many of our best sportsmen claim that the fishing for pickerel in waters that have been closed for a number of years is not as good to-day as before they were closed, different theories being advanced as to the cause."

Those interested in the pickerel and pickerel fishing have been forced to recognize that in a great many if not nearly all pickerel waters, where they once abounded and attained a large size, they have diminished in numbers and deteriorated in size. One or two examples will serve as illustration of facts well known, at least locally. As long ago as 1898 the writer made some observations and inquiries at Sebago Lake, Me. There an old resident fisherman informed him that pickerel were once abundant and of a much larger size in the lake and some of its tributary waters. By winter ice fishing they still caught some pickerel in the lake. Fish weighing 3 or 4 pounds each and the year before one of 7 pounds had been caught, but such fish were seldom seen in recent years. The lower part of the Songo River also harbored many large fish, but at this time one much over a pound in weight was a rarity. The pickerel observed by the writer in this place were small, poor, and often greatly emaciated, a fact that was surprising inasmuch as small minnows were very numerous in the so-called "bogs" or bayous where the pickerel were found. This latter fact is not easily explained, but the scarcity in both lake and Songo waters may be accredited to excessive fishing, particularly in the winter and in those days when market fishing was permitted. This was possible, notwithstanding the large size of the lake, owing to the fact that congenial pickerel waters in the lake were limited in number and restricted in area. The pickerel is supposed to have been indigenous to Sebago waters. Another lake in which pickerel were introduced may be cited as an example of deterioration. This is Umbagog Lake, the lowermost of the famous Rangeley chain of lakes. Umbagog is the only one inhabited by this fish, where they are reputed to have once been abundant and of large size, but as early as 1883 there were complaints of growing scarcity and the small size of the fish caught. To all appearances the conditions are ideally favorable for pickerel, which is supported by the fact of their former increase in number and size. Observations made there in 1905 by the present writer indicated that the claims of decrease and deterioration were true. Some remarkable explanations have now and then been offered.

There are two authentic reports of epidemic mortality among the pickerel due to unknown causes. One explanation was that pickerel had been suddenly frozen to death, but no explanation is offered

why other fish were not affected. A contributor to a sportsman's paper (Maine Woods, 1907) offered a decidedly striking explanation of the decrease of Umbagog Lake pickerel:

It is a well-known fact that the pickerel that inhabit Umbagog Lake are dying off rapidly. One man who is familiar with the lake advances the theory that they are being killed by hornpouts and this in a very peculiar way. This man says there are millions of hornpouts in Umbagog and that the pickerel devour them. He says: "The horns on the hornpout are always straightened out when the fish is in trouble, and this causes the death of the pickerel"—that they are "hooked to death."

It is doubtful if this hornpout is even a contributory factor in the death of the fish, and certainly there would not be epidemics of "hooking to death." The cause of such epidemics must be sought for by careful study of the fish and prevailing conditions, and even then it may not be revealed.

A gradual decrease in number and size of fish is more easily explained. The habits of the pickerel expose it to more dangers than are incurred by most other kinds of fresh-water fishes. To whatever extent it does or does not sustain its reputation for fierce and gluttonous voracity, those very qualities are its undoing. Whatever may have been its ability to maintain its existence in undisturbed natural conditions before man's attention was directed its way, the ease with which it is caught with any kind of lure, particularly in the winter and spring when congregated in restricted areas, have been decidedly adverse factors. Wholesale ice fishing has hastened its decrease by the destruction of practically every fish in the limited area and those larger fish which would have spawned that spring. Here, too, is the cause of decrease in size. The majority of large fish are caught, few succeed in spawning, and their progeny are in turn caught before they have had time to reach a large size. Consequently, there is a progressive decrease in number and size. While those that succeed in breeding deposit large numbers of eggs, doubtless but few survive. The character of the egg masses and their exposed situation in shallow water subject them to the ravages of other fishes, such as suckers, chubs, perch, etc., as well as reptiles and waterfowl.

A superintendent of one of the Pennsylvania hatcheries wrote that he estimated that fully 10 per cent of eggs deposited are devoured by other fishes before they are hatched and that storms sometimes sweep the eggs from where they are deposited and float them ashore, where they rot. He stated that he had seen hundreds of millions of eggs thus washed ashore and lost. But the reduction does not end there, for the fry from the time it is hatched is the common prey not only of various fishes, including its own kind, but also of reptiles, birds, and other animals. One would not suspect the common, toothless, innocent chub or so-called dace (*Semotilus bullaris*) of being a serious enemy of a fish that has been stated to

be able to take care of itself. Nevertheless, the present writer has observed chubs feeding upon young pickerel and has caught a dozen or so of these fish, of about one-half to 1 pound weight each, and found them gorged with pickerel 2 or 3 inches long. He has also seen a young pickerel chased and driven high and dry on a sand bar by a trout. The pickerel, a fish about 4 inches long, was secured and used as a bait by which the trout, which was about 10 inches long, was caught. The foregoing is sufficient to suggest that if the pickerel is to be saved several things are necessary. Constant increase or maintenance of numbers is possible only when adverse conditions are less or exactly equal to the favorable conditions. Maximum size is attained by any fish only when it is provided with sufficient food and room in which to grow and when it meets no check in its career. In other words, that means when favorable conditions preponderate over unfavorable.

One of the most potent of unfavorable conditions is that of unrestricted fishing. The fish must be protected sufficiently to permit enough to breed to maintain the stock, and the eggs and young should also receive protection so far as possible. It doubtless has become evident that the writer's views regarding the pickerel are more favorable to it than are those of many. Yet he would not advise introducing the fish into waters which contain other desirable fishes, particularly if those waters are small. In fact, he would not recommend it for pond culture at all, owing to the fact that for it to reach the desired perfection in size and quality and in sufficient numbers to make it worth while a large body of water well supplied with natural food is necessary.

It is advised that good natural pickerel waters should be kept in that condition or, if deteriorated, restored to the normal state, for having been naturally favorable for pickerel they are better for that fish than for any other that could be introduced. In order, however, to meet these requirements, the waters must be more than little ponds. They must be good-sized lakes or streams unless the stock is to be kept up by artificial propagation of both the pickerel and its food.

This article would be incomplete without a reference to the alleged usurpation of trout waters by pickerel. The present writer has previously had occasion to comment on this matter. He wrote (1913) that there is scarcely a body of water in which trout once lived and where pickerel now occur that the depletion of the trout has not been ascribed to the pickerel. It undoubtedly eats other fishes, and there are few fishes that do not. But the habits of the pickerel are such that it is not nearly so detrimental to other fish life as some other species held in higher regard, and the pickerel in large bodies of water become still less harmful. It is not much of a wanderer.



It does not rush about in marauding bands seeking what it may devour. It lies in wait and siezes what comes its way when it is inclined to feed, yet often schools of tempting shiners have been seen swimming unharmed in apparently dangerous proximity to big pickerel heads. Again he wrote (1894) that during most of the year it resorts to waters uncongenial to trout, and at all times it prefers such waters. A warm, muddy<sup>a</sup> pond or stream with profuse growth of aquatic vegetation is its favorite abode. Trout can not exist long in such surroundings. In weedy waters where trout manage to exist pickerel will also thrive, but trout will lie in the cooler, clear portions, while pickerel seek the water plants and shallow water. In most instances it would seem that the pickerel is not the whole, though possibly an accessory, cause of the disappearance of trout, and harm done by pickerel is overestimated. The injurious effect of pickerel upon trout and salmon is more often indirect than direct, especially when it appears in congenial waters where trout or salmon are barely maintaining themselves or decreasing. The indirect influence is upon the food supply, and this ultimately reverts upon the pickerel itself. It is an almost invariable rule that in time, after a period of increase in numbers and size, pickerel begin to decrease owing to diminution of the food supply.<sup>b</sup>

Referring to the same subject a number of years ago, after expressing similar sentiments to the foregoing, the writer remarked that excessive and destructive methods of fishing (to which should have been added untimely fishing), pollution of the waters, and the destruction of forests are far more fatal to trout life than their natural enemies.

#### AS A GAME FISH.

If the pickerel is not on the list of honor as a game fish, it is entitled to the distinction of being an exceedingly good sport fish. As for its game qualities even, in its way, it possesses some characteristics that equal the much-lauded trout. In fact, the writer has more than once found to his surprise that a pickerel was on his hook instead of the expected trout. The actions are much the same. If the tackle consists of the customary long bamboo or stiff wooden pole, stout line, and large hook, and the fish is lifted from the water by main strength, it must be confessed that in this kind of fishing piscatorial poets would find little inspiration. But use a light casting rod, a slender bait rod, or even a fly rod with about the same weight of line as one would employ for trout of like size, and no disappointment will be experienced regarding the gameness of the fish.

<sup>a</sup> The word "muddy" here does not refer to roily water, but to a muddy bottom, and "warm" is a comparative term meaning warmer than trout waters.

<sup>b</sup> This discussion refers mainly to comparatively small lakes or streams into which the pickerel have been introduced.

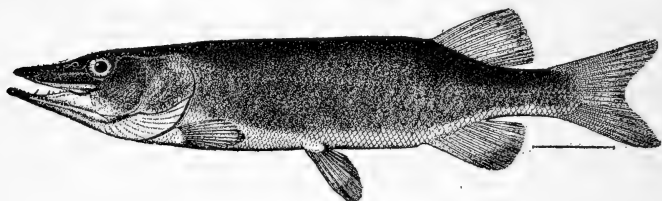
**BANDED PICKEREL** (*Esox americanus*).

## GEOGRAPHICAL DISTRIBUTION.

This little fish has a somewhat more restricted geographical distribution than the eastern pickerel. Its stated range (Jordan and Evermann, 1896) is from Massachusetts to Florida in lowland streams and swamps. It is found only east of the Allegheny Mountains, the westernmost record being from Escambia River at Flomaton, Ala. It may be added, the northernmost locality from which it has been reported is Lake Bomessen, Vt. (Kendall, 1908). Whether it is indigenous there the writer is not informed.

## NAMES.

Bean (1902) said that it is probably identical with the "mackerel pickerel" of Mitchill. Storer (1853) called it the "smaller pickerel," and it is referred to as the troutnose pickerel. Herbert (1849) and others mention it under the name of Long Island pickerel. Smith (1907) cited pike, red-finned pike, and jack as North Carolina names.

FIG. 5.—BANDED PICKEREL (*Esox americanus*).

## SIZES.

Most references state that it rarely exceeds a foot in length or it rarely exceeds a pound in weight. Herbert (1849) said that a pound was greatly above the average weight, which was probably not more than one-half pound.

## HABITAT AND HABITS.

*Habitat.*—The local habitat of this species is in general essentially the same as that of the eastern pickerel. It is found in shallow water amongst water plants, etc.

Bean (1902) said that it is especially plentiful in certain tidal creeks of Long Island, and Eugene Smith reports that it is often found in brackish water in the vicinity of New York, where it is brown in color.

Herbert (1849) described an individual which he stated was caught in a net in the salt water of Newark Bay. He wrote that it weighed something over a pound and a half and that it was in the finest condition. Its color, however, was remarkable, for the back and sides

down to the lateral line were of the richest and most lustrous copper color, paling on the sides into bright brazen yellow, with the belly of a silvery whiteness. The cheeks, gill covers, and fins all partook of the same coppery tone, and the whole fish was far more lucent and metallic than any of the family previously seen by him. There was not the slightest indication of any transverse bars or any mottlings nor was there any of that sea-green color which is so peculiar to the pike family.

*Habits.*—Its breeding or feeding habits have not been specifically described, but they are probably very similar to those of the eastern pickerel. Smith (1907), writing of the North Carolina fish, stated that its food is chiefly minnows, with which the stomach is often gorged.

#### FOOD AND GAME QUALITIES.

Bean (1902) wrote that the little banded pickerel is a fish seldom exceeding 10 inches in length, with flaky, white flesh, very few bones, and with delicious flavor, and that it is well worthy of the attention of fish culturists.

Smith (1907) said that in North Carolina it was of less importance as a food and game fish than *Esox reticulatus*.

Storer (1853) wrote that it was not infrequently noticed in Boston market, and that it was so similar to the *reticulatus* that it had previously been considered to be the young of that species.

#### LITTLE PICKEREL (*Esox vermiculatus*).

##### GEOGRAPHICAL DISTRIBUTION.

According to Bean (1902), its range is the valleys of the Ohio and Mississippi and streams flowing into the Great Lakes. He stated that Cope mentioned that it is also found in the Susquehanna, of which river it is probably not a native.

Forbes (1908) stated that its general range includes the tributaries of Lake Erie and Lake Michigan, extending thence southward to the Tennessee, Escambia,<sup>a</sup> and White Rivers and, according to Evermann and Cox, to the Neuse River on the Atlantic slope.<sup>a</sup>

It is stated (Evermann and Kendall, 1901 and 1902) to be rather common in all suitable waters of Lake Ontario and is recorded from Black Creek at Scriba Corner; Lake View, West Oswego; Wart Creek near Buena Vista; Great Sodus Bay; outlet of Long Pond near Charlotte; and Marsh Creek near Point Breeze, N. Y.

Cox does not record it from Minnesota, but Tomlin (1892a) wrote: "While fishing in a Minnesota lake one summer evening, I found a

<sup>a</sup> It is a noticeable coincidence that the Escambia River is given as a locality for both *Esox americanus* and *Esox vermiculatus*, and it is remarkable that it should be recorded from the Neuse River east of the Alleghenies distinctly in the range of *Esox americanus*. These records support the idea advanced by a student of these fishes, to which reference was previously made, to the effect that the two are specifically identical.

school of trout-pickerel \* \* \* common in this lake, and it was a handsome, clean fish."

#### NAMES.

Forbes (1908) referred to it as little pickerel and grass pike. This latter name appears also in many other publications. It is apparently the common name applied to it in the Pennsylvania Fish Commission's reports. Bean mentioned it also under the name of trout pickerel.

#### SIZE.

The general statements regarding its size are that it never attains a length of over 12 inches.

#### HABITAT AND HABITS.

*Habitat.*—According to Forbes (1908), it has a noticeable preference for quiet and muddy water, and a greater part of his collections

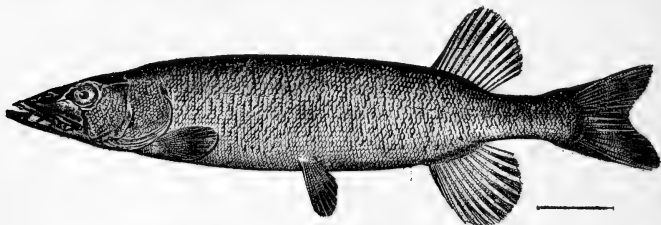


FIG. 6.—LITTLE PICKEREL (*Esox vermiculatus*).

were stated to have come from the weedy branches of the Embarras, Little Wabash, and Big Muddy in eastern and central Illinois. He wrote that it also occurred occasionally in the main stream of the Illinois or in the muddy overflow ponds of the bottoms. Indeed, large numbers of this fish are annually destroyed by the drying up of such ponds after the overflow.

*Feeding.*—Forbes (1908) stated that the feeding mechanism of this little species is a reduced copy of that of the destructive and voracious common pike, and its food, as illustrated by 18 specimens, seems to be of a purely animal nature. Two of these had eaten frog tadpoles and eight had taken fishes, one of which was a cyprinoid minnow, one a sunfish, and the other a common top minnow (*Gambusia*) of the southern part of the State. The remaining food was mostly composed of the larger aquatic insects. Amphipods and isopod crustaceans have been found in the stomachs of other specimens taken from Quiver Lake, near Havana.

*Breeding.*—Nothing definite appears to have been published regarding the breeding habits of this species. Forbes (1908) stated that it apparently spawns early and ripe individuals of both sexes had been seen by him in March.

## PROPAGATION.

The Pennsylvania Commission (1906) at one of its hatcheries undertook to hatch the eggs of the grass pike, and it was stated that no difficulty was found in taking the eggs but great difficulty was experienced in keeping them from sticking owing to their glutinous character. For some years more or less adult grass pike have been distributed by this commission.

## FOOD AND GAME QUALITIES.

A Pennsylvania report (1906) states that it is a valuable fish. It is rather small to figure much as a game fish.

## COMMERCIAL FISHERIES FOR THE PIKES.

The various early statistical reports afford but little definite data regarding any of these fishes, owing to confusion of local names and the combination of very different species under the common heading of "pike and pickerel," when very frequently one or the other refers to the pike perch. For this reason no general comparative statistics can be compiled. However, the three larger species have always been of some local commercial value.

*Pike.*—The U. S. census of 1908 gives four divisions in which "pike and pickerel" figure. The total catch for the United States, according to these figures, was 2,959,000 pounds, valued at \$194,000, excluding the Atlantic coast division, which can be regarded as including no pike.

From the other three divisions the figures were as follows, probably composed mostly of pike:

Divisions.	Quantity.	Value.
	<i>Pounds.</i>	
Great Lakes division.....	2,142,000	\$136,000
Mississippi River division.....	367,000	16,000
Gulf of Mexico division.....	305,000	11,000
Total.....	2,814,000	163,000

By States the figures appear as follows:

States. <sup>a</sup>	Quantity.	Value.
	<i>Pounds.</i>	
Illinois.....	14,000	\$1,100
Iowa.....	61,000	3,200
Michigan.....	478,000	32,000
Minnesota.....	351,000	11,000
Missouri.....	58,000	1,200
New York.....	90,000	9,600
Ohio.....	1,118,000	70,000
Tennessee.....	100	( <sup>b</sup> )
Texas.....	305,000	11,000
Wisconsin.....	317,000	23,000

<sup>a</sup> Other States not distinguished.

<sup>b</sup> Less than \$100.

In the foregoing list Ohio appears to be the paramount State, yielding nearly 40 per cent of the entire catch of the country, all of which was from Lake Erie waters. In 1899 the recorded catch of pike and pickerel of Ohio in Lake Erie amounted to only 739 pounds, valued at \$38, showing the astonishing increase in nine years of over a million pounds, with very little increase in price per pound to fishermen (about 1 cent).

*Pickerel*.—In the census of 1908 only the Atlantic coast division includes any appreciable quantity of pickerel, unless possibly New York, which has been placed with the other divisions in this discussion upon the assumption that the bulk of the catch was of the Great Lakes fisheries (Lake Erie and Lake Ontario), although some *Esox reticulatus* are doubtless marketed from the St. Lawrence River and some of the smaller lakes.

In New England commercial fisheries for pickerel are permitted only locally, being more or less protected as a sport fish. In 1898 there were 200 pounds recorded for Rhode Island and 5,420 pounds for Connecticut. In 1899 Maine recorded 300 pounds. No statistics are given for later dates except in Connecticut, which in 1902 yielded 8,230 pounds, valued at \$530.

The Atlantic division yielded 145,000 pounds, valued at \$11,000, most of which probably were *Esox reticulatus*, although some *Esox americanus* may have been included.

By States the catch was recorded as follows:

States.	Quantity.	Value.
	<i>Pounds.</i>	
Delaware.....	140,000	\$1,100
Georgia.....	1,100	100
Maryland.....	35,000	3,800
North Carolina.....	69,000	3,100
Pennsylvania.....	14,000	1,600
Rhode Island.....	600	100
Virginia.....	12,000	1,000

Of the aforementioned States, statistics are available for Delaware and Maryland for the years 1887, 1888, 1901, 1904, and 1908.

The figures are given for pike, which, if they are not intended for pike perch, doubtless indicate pickerel (*Esox reticulatus*) and possibly *Esox americanus*. In these years, also, New Jersey, which in 1908 shows no yield at all, has a comparatively large catch. The following table is given for what it is worth:

Years.	New Jersey.		Delaware.		Maryland.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1887.....	27,625	\$1,850	26,268	\$2,073	521,146	\$33,496
1888.....	30,400	2,066	25,389	2,031	577,745	37,286
1901.....	2,560	210	16,310	654	67,530	5,390
1904.....	600	55	11,050	544	42,317	3,716
1908.....			14,000	1,100	35,000	3,800

Statistics are also available for North Carolina for the foregoing years, excepting those for 1904 and 1901, the latter being replaced by those of 1902. Also, Virginia and Georgia record small catches for 1901 and 1902, respectively. There may be some doubt regarding the pike of Virginia and North Carolina, as they possibly may comprise some pike perch.

Years.	Virginia.		North Carolina.		Georgia.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1887.....			22,402	\$1,056		
1888.....			27,161	1,303		
1901.....	32,103	\$2,848				
1902.....			30,850	1,487	350	\$18
1904.....	3,644	2,954				
1908.....	12,000	1,000	69,000	3,100	1,000	100

In the first table a decrease is shown in the catch in each State, New Jersey completely disappearing. In the Southern States the quantity caught appears to have increased considerably. North Carolina gained 46,588 pounds, or over 148 per cent, in the 21 years from 1887, but fell off slightly in price per pound to fishermen.

The foregoing figures, taken with what is known about the pickerel, suggest that it does not breed and grow fast enough to furnish a permanent supply for any extensive or intensive fishery. The first table shows almost progressive decreases in three Middle States in proximity to large markets. While in the South an increase is shown, it is probably ascribable to more extensive and perhaps more intensive fishing in later years. It is safe to predict that unless the fishing is regulated a canvass of the fisheries a few years hence will show a decrease.

*Muskellunge*.—Owing to its restricted distribution and its importance as a game fish, this fish has never attained to any very considerable commercial fishery. The report of the United States Census of 1908 gives 25,000 pounds, valued at \$1,700, for the Great Lakes division. Michigan furnished 4,000 pounds, New York 19,000 pounds, Wisconsin 1,900 pounds, and Ohio less than 100 pounds. In 1902 New York alone yielded 92,650 pounds, valued at \$13,890, of which 85,400 pounds were taken in Lake Chautauqua. In New York these foregoing figures show a falling off of 67,650 pounds in six years.

The question is: Are the pike fisheries worthy of protection and conservation? According to the writer's view, they merit protection as a conservative measure for other so-called "better" fishes and as an economic provision. Consideration of the question will show that such a reason is not so paradoxical as it seems at first sight. The ever-increasing demand by a growing population hastens the decrease

of the fisheries for those species most in popular favor, which, when accompanied by neglect or waste of other edible but less-favored kinds, results in a general depletion, with the result that the more highly esteemed fishes rise in price beyond the purchasing reach of the majority, who are forced to seek cheaper fish food, only to find that there is not enough remaining to supply the demand. This unsatisfied demand affects the price of the so-called inferior fish, and it, in turn or in consequence, also moves upward. The writer is radical enough to believe that there is not an edible fish that swims that should not be conserved. The people of these United States are going to need them sooner or later if they do not already.

It may be added that, as a rule, native species are naturally the easiest to conserve, and indiscriminate stocking of waters with new kinds is not to be recommended. The Biblical injunction about new cloth and old garments or new wine and old bottles is applicable to waters and fishes.

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**NOTES ON THE LIFE HISTORY OF THE MINNOWS  
GAMBUSIA AFFINIS AND CYPRINODON  
VARIEGATUS**

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**Appendix VI to the Report of the U. S. Commissioner of Fisheries for 1917**

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# NOTES ON THE LIFE HISTORY OF THE MINNOWS *GAMBUSIA AFFINIS* AND *CYPRINODON VARIEGATUS*.

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## INTRODUCTION.

The observations and experiments upon which the present paper is based were made in the Beaufort, N. C., region, partly in the laboratory and partly in the field, from April, 1914, to October, 1915. Only living fishes are considered and the experiments in aquaria have probably afforded the most interesting data. While some of the observations here recorded are in general harmony with the published statements of previous investigators, yet they are found to present such essential points of difference as to make it advisable to include them in the present paper. The fact that these and other minnows are now so highly esteemed as agents for the destruction of mosquito larvæ in ponds and reservoirs lends a timely interest to the publication of any data relating to the habits and propagation of the species.

## **GAMBUSIA AFFINIS (Baird and Girard). THE TOP MINNOW.**

### NATURAL HISTORY.

This top minnow is known on the Atlantic coast from Delaware to Mexico and in the Mississippi Valley from Illinois to Louisiana. It inhabits both fresh and brackish water, while an occasional straggler is taken in strictly salt water. Locally it is the only viviparous teleost known. It may be found in nearly all shallow streams or ponds of brackish or fresh water, and it is particularly abundant in certain very shallow and muddy arms of the Mullet Pond on Shackleford Bank. Nowhere, however, was it found to grow so large as it does in a small fresh-water pond on Gallants Point. Females taken from this very shallow and extremely dirty pond, visited daily by both cattle and hogs, are from 60 to 65 mm. in length, while the largest specimens obtained elsewhere do not exceed 45 mm. The males, as is well known, are much smaller than the females. The largest male observed in this vicinity was 33 mm. in length, which is probably 6 mm. above the average.

This fish is one of the hardiest known to the writer. It flourishes in very stagnant water, providing, of course, that the proper amount of food is available; it thrives in the aquarium; and it lives equally as well in salt as in fresh water. It may be plunged directly from the one into the other without any apparent harm. If placed in a battery jar and left without change of water it will usually survive until a green scum forms on the walls of the container; thereafter no more attention need be given it, except to add a small quantity of water from time to time to compensate for evaporation. Care must, of course, be exercised not to give the fish more food than it can consume. Probably more aquarium fish of all kinds are lost through overfeeding than from any other cause. Both old and young have been kept in the aquarium at the laboratory for one and one-half years, and were still in good condition at the expiration of that period.

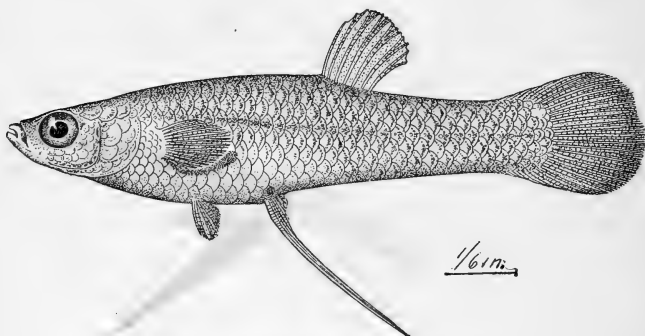


FIG. 1.—*Gambusia affinis*. Top minnow. Male.

*Gambusia* becomes inactive and ceases to feed even during moderately cool weather. It is at its best in water of a relatively high temperature. The shallow water in which it is usually found in abundance during the summer reaches a temperature, during the day, which is above that of the human body. It is never a very active swimmer, and when it ventures out into water inhabited by larger fishes it becomes an easy prey. Its habit of swimming at or near the surface is well known, and this has caused it to be known everywhere throughout its range as the top minnow. When in very stagnant water it projects its mouth above the surface at frequent intervals, making a sucking noise each time. It is presumed that this is done because there is an insufficient supply of free oxygen in the water, but if this is the case the deficiency of oxygen does not appear to interfere with the health and welfare of the fish. The large size attained by the minnows in the stagnant pond on Gallants Point may be cited as evidence.



## OBSERVATIONS ON FEEDING.

The habit of surface swimming in this species is correlated with the fact that it seeks and acquires most of its food at or near the surface of the water. It feeds very largely upon the larvæ of insects when these are available; accordingly, it has been found to be of great value as an eradicator of mosquitoes, and herein lies its greatest economic importance. For this reason, also, it has been planted in many places where it is not native, and the results have been gratifying. While aquarium feeding does not, as a rule, teach us much about a creature's habits of feeding in nature, a few experiments in this connection are nevertheless worthy of mention. An adult female, about 43 mm. in length, had been held in a battery jar since early spring and regularly fed with finely minced fish. On August 2, 1914, she was fed 140 mosquito larvæ between 11 a. m. and 12.15 p. m. The larvæ were all of large size and nearly ready to pupate, being from 6 to 8 mm. in

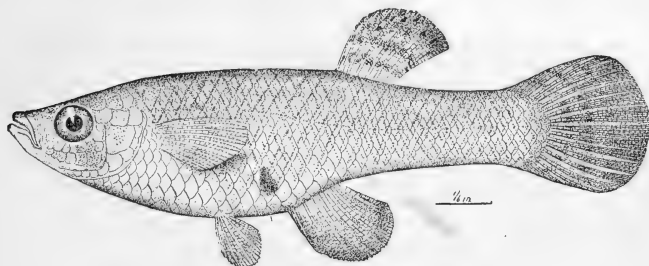


FIG. 2.—*Gambusia affinis*. Top minnow. Female.

length. All except four were eaten by 12.30 p. m. When observation was made again at 5.30 p. m. all the larvæ had been consumed. At 6 p. m. 25 additional larvæ were supplied. Nearly all of these were immediately eaten, and all had disappeared by 9 p. m. It was clear, however, that her appetite was satisfied. The abdominal walls were greatly distended and it was evident that she had eaten all that she could hold.

That its service in the destruction of mosquito larvæ probably begins on the day that the fish is born is evidenced by the fact that fish only a few hours old devoured larvæ that were fed to them. At this early age they were unable to swallow large larvæ, but the writer has seen them swallow larvæ more than half the total length of the fish itself. Considerable difficulty is apparently encountered in swallowing a morsel of this size, and a portion of the larva is often visible 1 minute after the process of swallowing is begun. It was sometimes observed that one such morsel did not satisfy the appetite and that a second one was taken.

While this fish in captivity will readily eat dead food, such as minced fish, oysters, clams, corn bread, the yolk of hard-boiled egg, etc., it shows a preference for living food. Mosquito larvæ were killed and introduced along with live ones, and in each instance no attention was given to the dead larvæ until the live ones had been consumed. It is probable that this fish has a preference for insects as food, but it is evident that it is by no means dependent upon these for subsistence. Apparently it devours nearly anything of suitable size, whether animal or plant. It is well known that in the aquarium *Gambusia* will eat its own young, but this cannibalistic habit is certainly not restricted to aquarium life, since the writer has captured specimens in nature which contained in the stomachs fish of their own kind.

#### OBSERVATIONS ON BREEDING.

In the Beaufort region this fish delivers its first young of the season some time during May, or in some years possibly as early as the latter part of April, depending largely upon the temperatures which prevail during the early spring. The spring of 1915 was somewhat cooler than the spring of 1914, and the breeding season, therefore, began at least two weeks later. It continues to breed throughout the summer and as late as October.

Copulation, although carefully looked for, was not satisfactorily observed. Apparently it is a very quick process<sup>a</sup> and is accomplished during what appear to be frequent fights in which the opposite sexes engage. That some of these fights are quite real was evidenced by the fact that a female which was confined in a small rectangular jar killed and partly devoured three males that were from time to time introduced for breeding purposes. In order to protect the male from this ferocious female it became necessary to place in the jar a partition of wire netting, with mesh large enough to permit the male to pass through, yet small enough to keep the female back. The male continued to venture out from his compartment quite frequently, and notwithstanding that he was obliged to make many hasty retreats he survived and successfully fertilized the eggs for the future broods.

That a single female may produce as many as six broods of young during a single season was demonstrated through aquarium experiments. In one instance a medium-sized female, about 40 mm. in length, was placed in a small rectangular jar early in the spring of 1914. She gave birth to young as follows: First brood, May 20;

<sup>a</sup> The act of copulation in *Gambusia holbrooki* and *Heterandria formosa* was observed and described by Seal (1911). *Gambusia holbrooki* is now considered a synonym of *G. affinis*. This process was also observed and described by Philippi (1908) in *Glaridichthys januaricus* and *G. decemmaculatus*. (The first of these fishes according to Henn (1916) was *Phalloceros caudomaculatus* (Hensel) and the other is placed in the genus *Cnesterodon* Garman by the same author following Eigenmann.)

second brood, July 2; third brood, July 18; fourth brood, August 9; fifth brood, August 30; and sixth brood, October 5. It is probable that some females produce an even greater number of broods during a single season, for it was noted that several females in the aquaria gave birth to young during a period of two to three weeks after the individual just cited had concluded for the season; some also began bearing at an earlier date than this one. Presumably the effect of aquarium life would be to reduce rather than to increase the number of broods. As the temperature of the water seems to determine the time of beginning of the spawning season, it probably influences, to some extent at least, the rapidity with which the later broods are developed. The aquarium in which the above-mentioned female lived was kept in the writer's office, where it was protected from the direct rays of the sun. The water in it, therefore, never reached the luke-warm temperature of that usually occupied by these fish in nature, and for that reason it may be supposed to have exercised a retarding influence upon the development of the successive broods.

The number of young comprising a single brood appears to bear a direct relation to the size of the female. If the female is small, a small brood results. If the female is large, a more numerous brood may be expected. That the earlier broods are larger than the later ones, as suggested by Dr. H. M. Smith (1912, p. 224), could not be verified. A large number of dissections of specimens obtained at various times during the season revealed no differences that would substantiate that suggestion. In the same paper Dr. Smith states that the average number of embryos contained in the ovary of a limited number of fish dissected or observed by him at the aquarium of the Bureau of Fisheries in Washington was 100. Dealing with specimens from the Beaufort region, the largest number found by the present writer in any single ovary was 63, and the average among the largest females obtained did not exceed 40. Dr. Albert Kuntz (1914, p. 183), working with fishes from the Beaufort region, found 76 to be the maximum number produced by a single female. The fish examined by Dr. Smith were from the Potomac River and measured from 45 to 50 mm. in length. They were, therefore, not so large as some of the specimens under observation at Beaufort, the largest of which are 64 mm. in length. The number of broods of one season produced by a single female in a more northern latitude are probably fewer in number, owing to the shorter period of warm weather; but since the observations of Dr. Smith suggest that the broods may be larger, it is possible that the number of young produced during a single season is not materially smaller in the higher latitude.

It is an interesting fact that females separated from males even before the first spring brood is born continue to produce young

throughout the season in a perfectly normal way.<sup>a</sup> A female kept under close observation produced five broods after she had been separated from all other fish. To determine if fish that were separated from males in the spring would continue to produce young the following season without again coming in contact with males, a number of females were kept in aquaria through the winter. In the following spring large eggs, of yellowish appearance, were produced instead of young. Other females that had been with males during the entire summer were separated from them late in the fall and also carried through the winter. This lot, too, produced eggs instead of young. In each case the eggs appeared when young would normally have been produced. These experiments show that this fish is able to carry the sperms throughout the breeding season, but indicate that it can not carry them through the winter.

Ova in various stages of development are present in the ovary at one time. When one brood is born the eggs of the next set are already well developed, being about 1 mm. in diameter, and several smaller eggs are also present. When the fertilization of the different sets of eggs occurs is not known. With regard to *Phalloceros caudomaculatus* and *Cnesterodon decemmaculatus*, two viviparous forms belonging in the same family with *Gambusia affinis* (the family Poeciliidæ), Philippi (1908, p. 22) found that the sexual product of the male consists of numerous milk-white bodies which stick fast to the first available object. Microscopic examination showed that these bodies consist of closely crowded spermatozoa. The whole mass is held together by a sticky substance, which probably causes the sperm bodies to fasten themselves to the genital papillæ of the females. He found also that these bodies were quickly dissolved when they came under the influence of the ovarian fluid, and the individual spermatozoa were set free. Within the folds of the lining of the oviduct the sperms were found in great numbers, even after the birth of young. It is probable that the sperms are retained there throughout the breeding season and that the eggs are fertilized as soon as they are sufficiently mature.

The fact that the female is capable of producing young throughout the breeding season without coming in contact with the male leads one to look with suspicion upon the many notices of "hybrids" produced by crossing species of viviparous fishes. In order to obtain true hybrids of *Gambusia affinis* with another species, if such cross-breeding will occur at all, it would be necessary to begin the experi-

<sup>a</sup> "Zolotnisky (1901, p. 65) observed that a female of *P. caudomaculatus* which had been separated from males after the appearance of a brood of young produced another within six weeks and a third brood four weeks after this. This occurred although copulation subsequent to the first parturition had not taken place. Philippi also isolated females at, or slightly before, parturition. In every instance the females became pregnant for a second time, and one specimen produced a third brood 46 days after the appearance of the second. Poey noted these facts many years ago." (Henn, 1916, p. 102.)

ment during the fall or winter or to rear young for the purpose, in which case the sexes must be segregated at a very early stage.

As the embryos develop within the ovary a black spot appears on each side of the abdomen of the parent above and in front of the vent, and these spots gradually become larger and larger. When they become so large that they are about to meet at the ventral surface, the period of parturition is at hand. The process of extrusion of the young was observed repeatedly. There is no uniformity in the manner of birth. They may appear singly or by twos and threes at a time. Some come head first, some tail first, and others are delivered in a coiled position. Extrusion may occur quickly and with some apparent force; at other times it is a slow and deliberate process. Some females under observation delivered nearly the entire brood in one position, but others did not. It appears that the young are most frequently born tail first and one at a time. The process invariably takes place during the day. The entire brood may be delivered in the course of an hour or two, or the process may consume an entire day or a portion of two days. During this period the adult swims about as usual and eats food when it is supplied. If hungry, she devours her own young as rapidly as they are born. In many instances in the aquarium the mother eats her entire brood on the day they are born.

The young at the time of birth are from 8 to 10 mm. in length. They are very vigorous, and, as previously indicated, they come into the world with an appetite and well prepared to enter upon an independent career. The average rate of growth is rapid, but, as is the case with other forms of animal life, each lot has its "runts." The largest female among a lot born in May, 1914, and reared in the aquarium had reached a length of 25 mm. by the middle of September. The recognizable males were somewhat smaller, although the difference in size was not nearly so great at this age as it is among fish that have attained their full growth. The smallest individuals in this lot were only 13 mm. in length. In the field, by about July 30 it became difficult to distinguish the first young of the season from the adults. The largest specimens taken at this time and identified as young of the season were 25 mm. in length. From this it would appear that the young in natural habitats grow faster than those in captivity. Fish born and reared in the aquarium now nearly one and one-half years old have not quite reached the maximum normal size of their parents.

The external character distinguishing the sexes is the modified anal fin of the adult male, which is developed into an intromittent organ. In the young, however, the anal fins are similar. The modification of this fin in the male is a gradual process and can not be said to become evident at a stated age or length of the fish. In some

specimens the specialized form of the fin becomes evident when the fish is only 13 mm. in length and less than 3 months old; in others it is not apparent at the age of 5 months or at a length of 17 mm. For example, a lot of 43 young born in May, 1914, the smallest of which was 17 mm. in length, was examined on October 15, 1914, and was thought to comprise females only; but on June 3, 1915, 6 of the 39 fish surviving were easily recognized as males. It may, therefore, be stated that the modification of the anal fin into an intromittent organ may take place when the fish reaches a length of 13 mm., or at any later stage until it attains its maximum normal growth of about 25 mm.

The proportion of males to females in this species has been discussed by various writers. In collections the males are generally much in the minority. It has been argued that this is due to the small size of the males, which permits them to pass through the meshes of nets and thus to escape capture. However, when the writer has collected the minnows with mosquito netting of a mesh so small that not even the tiniest male may pass through, the disparity in the numbers of the sexes has remained evident. Among the lots grown in the aquarium, the inequality is quite as great as it seems to be in nature. For example, on June 2, 1915, 60 of the young of the previous season had survived, and of these only 7 were males. The indications are that in the broods of 1915 the sexes are just as unequally represented, although, as shown above, the sexes can not be positively determined at this time (October, 1915). Owing to the rather heavy loss during the early stages of life in the aquarium, the results as stated above may not afford a reliable criterion, although there is no apparent reason why aquarium life should not be as well suited to the male as to the female. Among the adults there is much fighting between the sexes and the males often suffer severely, but among the young these disastrous conflicts have not been observed. It seems entirely probable that the normal ratio of males to females is about 1 to 8 or 9.

The extreme prolificness of the species has already been the subject of comment. It is particularly interesting to know that the early broods of the season reach sexual maturity<sup>a</sup> and some of the fish begin to breed before they are four months old. During both seasons that the young have been observed and grown in the aquarium the oldest and largest females among the broods have delivered their first young during September. At this time the females are only about 23 mm. in length, and the first brood consists of only two or three young. In the fall of 1914 two of the largest females hatched

<sup>a</sup> Seal (1911, p. 95) observed that the young of *Gambusia holbrooki* and *Heterandria formosa* began to breed during the season in which they were born.

in the spring of the same year even succeeded in producing two small broods before the arrival of cool weather.

A female that produced 6 broods during one season, averaging 40 young to a brood, would have 240 descendants of the first generation by the end of the season, assuming that all survived. Now, if the sexes in the first brood occurred in the apparently normal proportion of 5 males and 35 females, and if each female produced three young in September, the total number of young of the second generation resulting from this brood would be 105. It appears that by the end of the season the original female would have given rise to a family of 240 offspring of the first generation and 105 offspring of the second generation. There are few, if any, fishes whose output of eggs does not outnumber the young of *Gambusia*, but the chances of survival for young delivered alive as compared with eggs and young hatched from them, are probably 1,000 to 1. It seems reasonable to conclude, therefore, that under natural and normal conditions no native fish multiplies more rapidly than *Gambusia affinis*.

#### SUMMARY.

1. *Gambusia affinis* usually inhabits shallow, stagnant waters, whether fresh or brackish, and it thrives under conditions of relatively high temperature if the proper amount of food is available.

2. It is a very hardy fish, adapting itself readily to many different natural conditions as well as to life in the aquarium.

3. Its food consists largely of the larvæ of insects, but it feeds also upon a variety of other animal and plant substances. It sometimes eats its own kind, even its own offspring, especially in the restricted environment of an aquarium.

4. One medium-sized female may destroy as many as 165 large mosquito larvæ in a single day.

5. In the region of Beaufort the fish produces its first brood of young for the season during the month of May and continues to breed throughout the summer until as late as October. It may produce during a single season six or more broods, averaging 40 young to a brood.

6. Females separated from males in the spring shortly before the first brood is born continue to produce young throughout the season. If separated from the male even during late fall no young will result the following spring, but infertile eggs will be deposited.

7. Young are delivered during the day, one, two, or three at a time. Some come head first, some tail first, and others in a coiled position. The period of labor may comprise an hour or the greater portion of a day or even portions of two days.

8. The modified anal fin of the male, which is the external character that distinguishes the sexes, may be fully developed when the fish

is less than 3 months old or not until the fish is 1 year old; it may appear when the fish is 13 mm. in length, or be delayed until a length of 23 mm. is attained.

9. The proportion of males to females appears to be about 1 to 8 or 9.

10. Some of the individuals of the early broods of the season become sexually mature and produce small broods of young late in the season in which they themselves were born.

**CYPRINODON VARIEGATUS (Lacépède). THE VARIEGATED MINNOW.**

This variegated minnow occurs on the Atlantic coast from Cape Cod to the Rio Grande, inhabiting brackish waters and ascending streams. Stragglers are also taken in strictly salt water. Locally

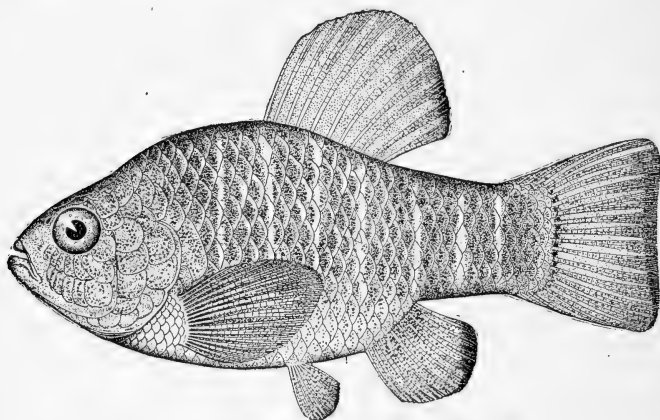


FIG. 3.—*Cyprinodon variegatus*. Variegated minnow. Male.

it is very abundant in the shallow brackish ponds, but it does not appear to attain as large a size as it does in some other localities. The usual length of the adult female is only about 45 mm.; the adult male is somewhat larger, averaging about 48 mm. in length and being notably deeper in body than the female. The sexes appear to occur in equal proportion.

The fish is an active swimmer and very ferocious. In captivity it will kill and devour fishes of other species much larger than itself. Even such species as *Fundulus heteroclitus* (Linnæus) and *Fundulus majalis* (Walbaum), which are ordinarily quite aggressive, are unable to withstand its attacks. Its sharp, tricuspid teeth afford a very effective weapon. It makes its attacks by darts, inflicting a wound here or there, and then quickly turning for defense. After a brief



period another attack is made, and this is kept up until the victim is exhausted or disease attacks the wounds. In several instances it was noticed that a number of individuals made a concerted attack upon one common victim. Where the prey is large and can not be devoured whole, the flesh is ripped from the bones with the sharp teeth and eaten a bit at a time. *Cyprinodon* does not limit its attacks to fishes of other species. When a number of them are placed in an aquarium, fighting soon ensues among their own kind and cannibalism prevails.

It is apparently a voracious feeder, with a varied diet. In nature it appears to subsist largely upon vegetable matter. The stomachs that were examined were found to be distended with plant stems, algæ, and mud. The nature of the digestive tract, which is much convoluted and equal to about two and one-third times the length of the fish, indicates that plants form the principal natural food.

In 1914 it was noticed that this fish spawned throughout the summer, so that ripe females could be obtained at nearly any time from April, when the observations were begun, until October. It was also found that there were several sizes of eggs present in the ovary at one time. These facts suggested that this fish produced more than one set of eggs during a single season. In order to obtain more definite information in regard to this matter, the following experiments were undertaken: A rectangular box was constructed with four legs and with a hole in the bottom near one end. Beneath the hole there was tacked a piece of wire netting, the meshes of which were too small to permit the escape of the fish to be used in the experiment, but large enough to allow the eggs to pass through, should any be produced. This box was placed in a compartment of a hatching table provided with an overflow and connected with drain pipes. Underneath the hole in the bottom of the box a small basket of wire gauze was placed. The opposite end of the box was somewhat elevated. A small stream of salt water was allowed to flow in at the elevated end, thus creating a current directed toward the opening in the bottom at the opposite end. The purpose of the current was to carry the eggs through the screened opening and cause them to be deposited in the small gauze basket. On April 10 a large female was placed in the box, where she lived until September 20. Eggs were produced on the following dates: April 28, May 28, June 14, daily from June 24 to July 3; July 16, 17, 19, 22, and daily from July 24 to 31; August 9, 11, 13, and 16. The first three sets consisted of from 18 to 24 eggs each and the remainder of only from 2 to 6 each. When the female died on September 20 she was completely "spawned out." It is, however, probable that all of the eggs that were produced did not reach the retaining basket, as dissections indicate that the early sets at least are usually much larger. It is possible that the parent may have eaten

some of them before they reached the wire screen. Several dissections made on April 17 showed that the ovary of a large female contained about 140 well-developed eggs, fully half of which seemed to be of one size and generally nearly mature. To acquire more data on this point, artificial spawning was tried with a number of females. The process of stripping, however, involves more handling than the species endures, and none of the females lived to produce more than two sets of eggs.

Females of this species may be found in spawning condition as early as the middle of March and as late as October 1. Whether the early spawners continue to spawn as late as October or if these late spawners are those that began spawning later in the season is not known. Our aquarium specimen, which was an early spawner, had, under abnormal conditions, spawned out by August 16.

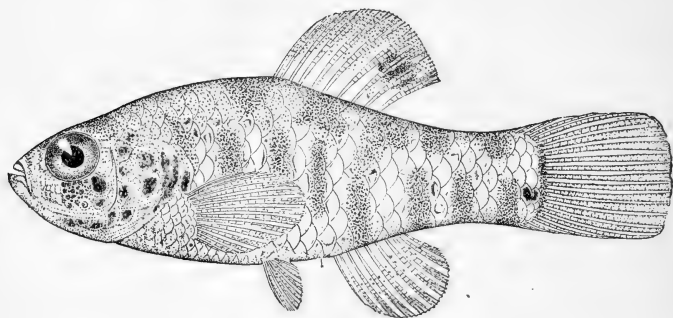


FIG. 4.—*Cyprinodon variegatus*. Variegated minnow. Young.

The eggs of this species are somewhat heavier than salt water. They are spherical in form and about 1 mm. in diameter. Incubation at laboratory temperature occupies five to six days. The newly hatched young are 4 mm. in length (Kuntz, 1916, p. 414). They grow rapidly and by the beginning of August some of the largest are as much as 32 mm. in length. Up to this age the sexes are colored alike and resemble the adult female, but at about this time the young male assumes the adult markings and hereafter it can with difficulty be distinguished from an adult male.

My observations show that this is a very prolific species, and its fecundity may be held to explain in a measure its great abundance. It is said to be of some value as an eradicator of mosquito larvæ, but its greatest economic importance probably lies in the food it furnishes for larger fishes.

In this connection it may be mentioned that observations in the field and dissections made at various times during two seasons strongly

indicate that the following species, common in this vicinity, also produce more than one and perhaps several sets of eggs during a single season: *Lucania parva* (Baird and Girard); *Fundulus heteroclitus* (Linnæus); *Fundulus majalis* (Walbaum); *Fundulus ocellaris* (Jordan and Gilbert); *Fundulus luciae* (Baird and Girard); *Menidia beryllina* (Cope); and *Menidia menidia* (Linnæus).

## SUMMARY.

1. *Cyprinodon variegatus* inhabits shallow, brackish ponds and ascends fresh-water streams. Stragglers occur in strictly salt water.

2. Its principal food consists of vegetable matter, but it probably feeds also on many kinds of animal life. In captivity it is very ferocious and attacks and eats its own kind.

3. In the Beaufort region this fish spawns from March till October, producing eggs at intervals of varying length. Periods of 10 days or a month may intervene between occasions of spawning or eggs may be deposited daily for a considerable period.

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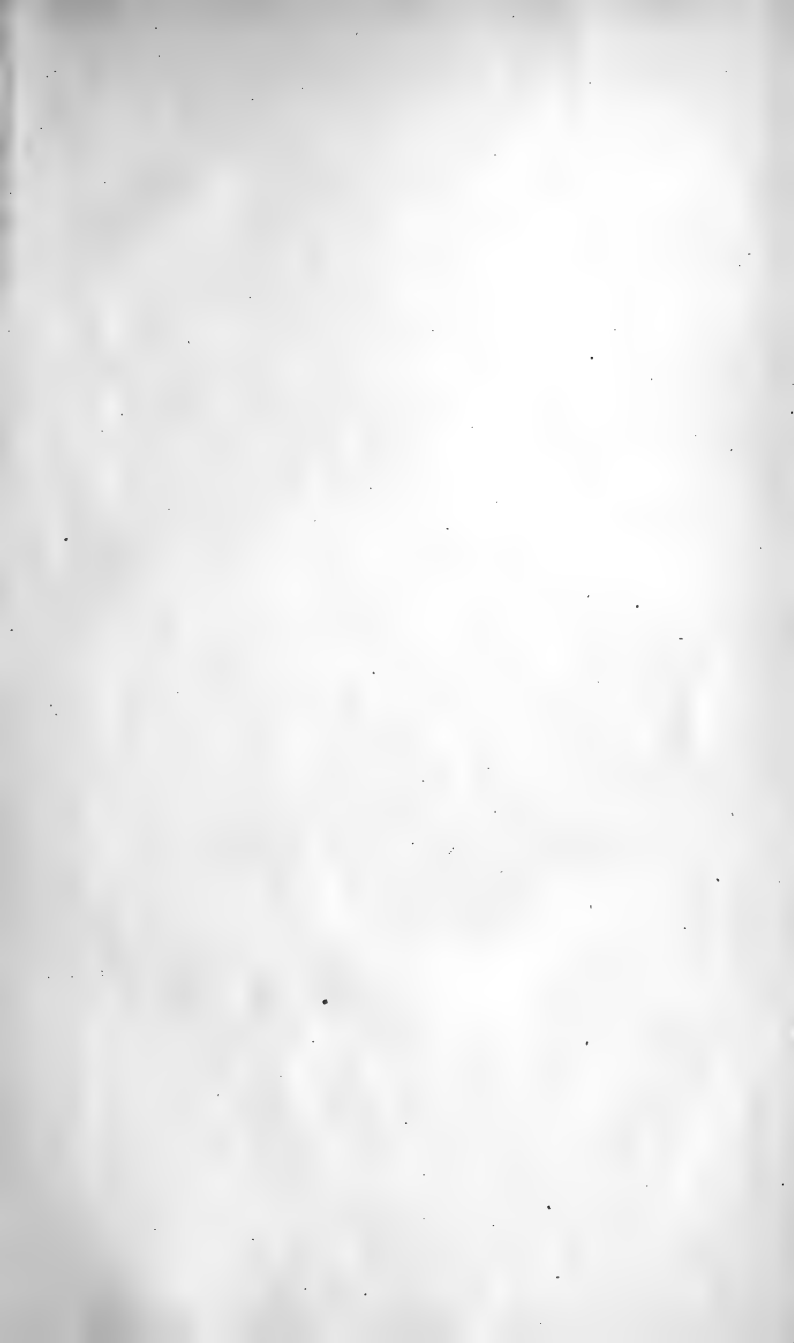
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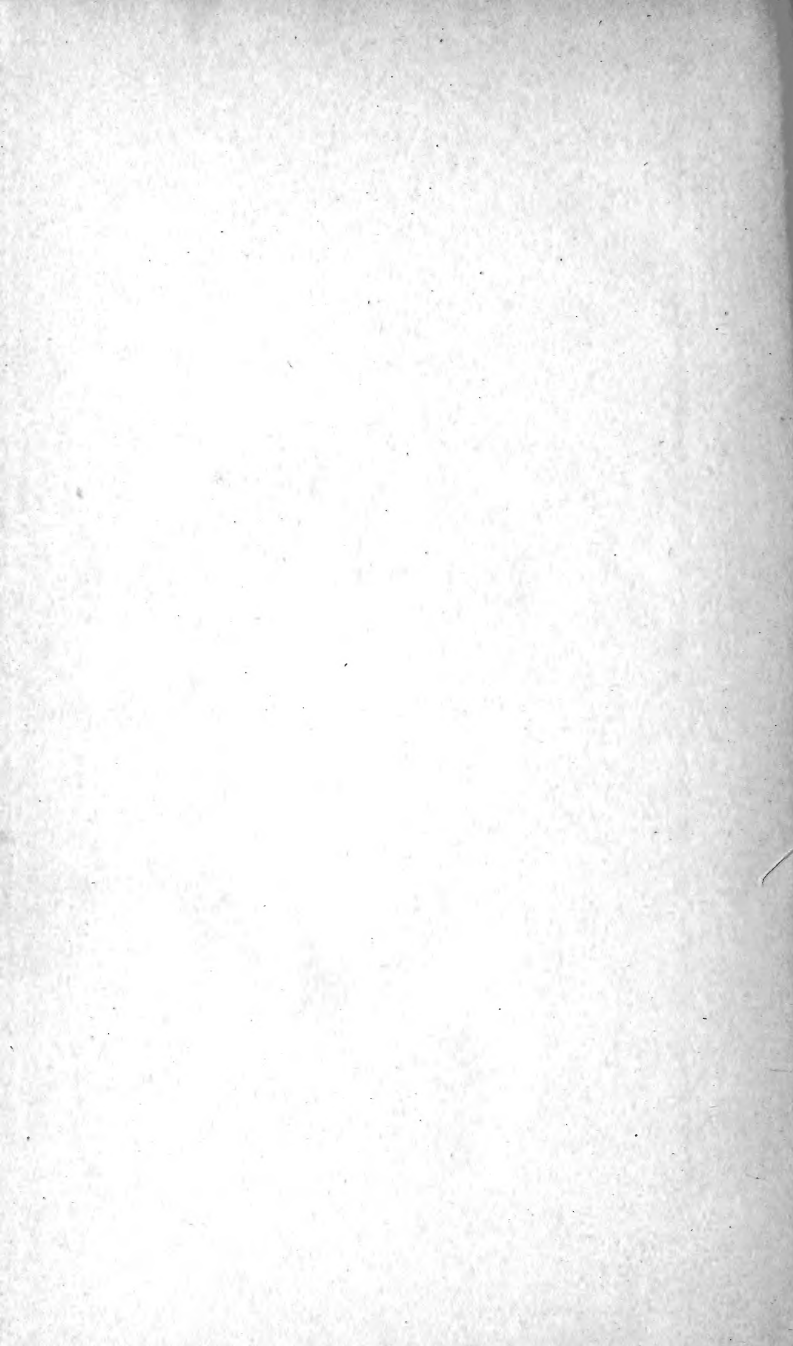


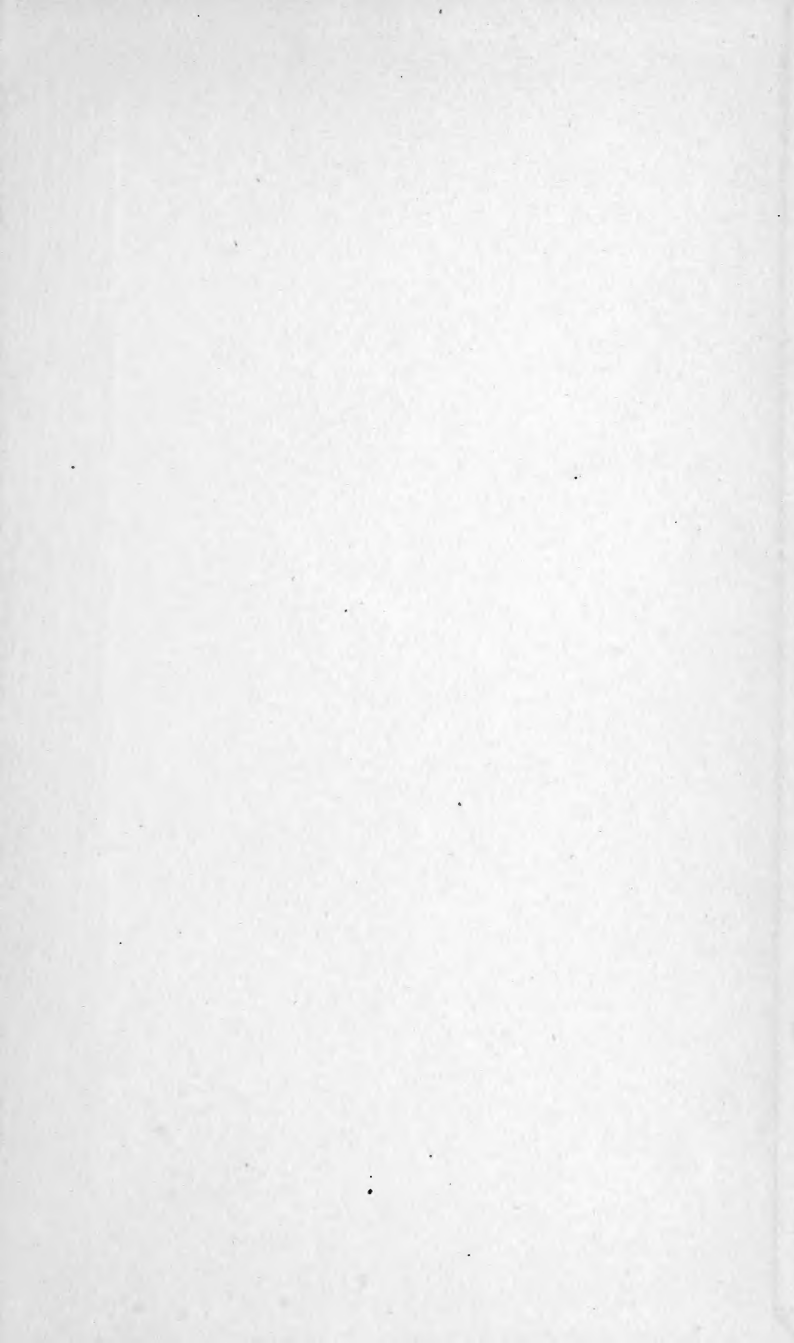












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